COAL AGE

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The Lesson

Written expressly for Coal Age

BY BERTON BRALEY

There is no "Private Business" any more,
No trade that we can manage as we choose,
For in the mighty holocaust of war
The Nation's need comes first, and we must lose
Our petty pride in personal success
And merge ourselves in one tremendous whole,
Break from the fetters of our selfishness
And help our land to win the war with coal.

There is no "Private Business" any more,
That is a fact which we must recognize,
The interests that we have served of yore
Are lost in this titanic enterprise;
Nothing we own is ours, but held in trust
To serve the Nation in its greater need,
The individual is less than dust,
"All for our country" is the business creed.

Annihilate the Hun

Brushed Aside

There is no "Private Business" any more,
No man may say: "This enterprise is mine,
Which I shall manage, as I have before,
According to the plans that I design";
That old conception has been brushed aside
By vast events and we have come to know
That if the things we care for shall abide
Our little private interests must go.

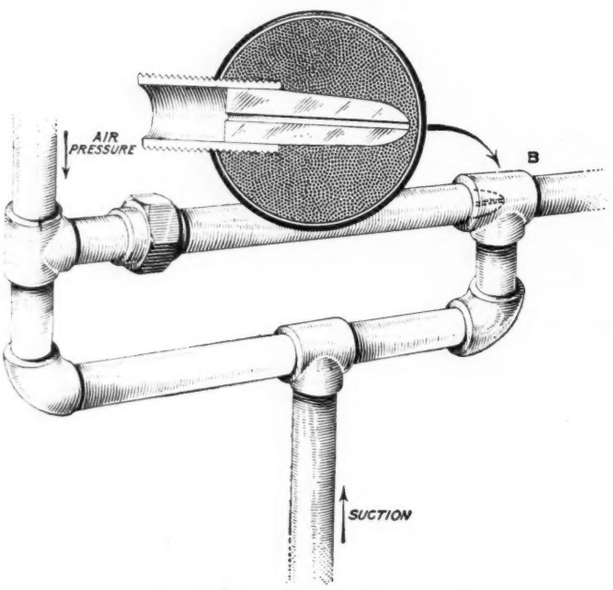
Tipple and breaker, gallery and seam,
No longer are they ours; they help to make
The strength of that huge economic scheme
Which backs our men who fight for freedom's sake.
We've yielded much of "vested rights" and power—
We shall yield further at the call of war;
Our selfish plans are nothing at this hour,
There is no "Private Business" any more.

IDEAS AND SUGGESTIONS

A Duplex Ejector

BY L. V. LAUTHER
Guttenberg, N. J.

Most men about coal mines are familiar with the ordinary type of homemade ejector composed essentially of a tee with a suitable nozzle screwed into one run opening, the discharge screwed into the other while



COMPOUND HOMEMADE EJECTOR

the outlet opening receives the suction. This type of ejector while fairly successful for low heads is not powerful. The accompanying illustration shows what might be termed a "duplex" ejector. While it is somewhat more elaborate than the "simplex" ejector it is also more powerful. The construction is simple and needs no comment. For 1-in. pipe and fittings the nozzle opening should be about $\frac{5}{16}$ in. in diameter.

How Soon Will Heat-Insulating Material Pay for Itself?

BY W. F. SCHAPHORST
New York City

The caption states a problem that should certainly interest the owner, superintendent, engineer and everybody else connected with the economic problems that must daily be met in and about a power plant. At first blush it may seem like a rather indeterminate problem, but elaborate tests have been made on the subject of heat transmission through bare pipes, and on these I have built a formula giving the cost of the heat loss in any number of hours. By reversing the formula it is possible to compute the number of hours required for a given heat-insulating material to pay for itself.

The formula is as follows:

$$H = \frac{2000PBE_b}{(1.6 + 0.0056D)DACE_c}$$

where

H = Number of hours required for the covering to pay for itself;
P = Cost of pipe covering per lineal foot;
B = B.t.u. per pound of coal;
E_b = Efficiency of the boiler;
D = Temperature difference in deg. F., or the metal temperature minus the room temperature;
A = Area of the metallic surface in square feet;
C = Cost of coal per ton of 2000 lb. in dollars;
E_c = Efficiency of the covering.

It is quite possible that this formula will give rather surprising results in a good many cases. The opinion of many is that a covering will pay for itself in a short time. They over-estimate the value of pipe covering and heat insulation in general, because the value of coverings is a subject that has been harped on for many years. Others have a tendency to sneer at coverings, claiming that prices are so high that they never pay for themselves. However, let us take an example and by means of this formula see for ourselves. Let us take a case where

P = $2 per lineal foot;
B = 12,000;
E_b = 70 per cent.;
D = 200;
A = 3.1416 sq.ft., or the area of a pipe 1 ft. in diameter and 1 ft. long;
C = $4;
E_c = 90 per cent.

Substituting in the formula we get

$$H = \frac{2000 \times 2 \times 12{,}000 \times 0.70}{[1.6 + (0.0056 \times 200)]200 \times 3.1416 \times 4 \times 0.90} = 5480\ hr.$$

which is equivalent to about 228 days, assuming that the pipe was under steam continuously, day and night. If the steam periods are intermittent (as is often the case in heating systems) the number of days, of course, will be greater. Thus in some heating systems where the pipes are under pressure for approximately 109 days per year it will take a trifle over two years for the covering to pay for itself. But insulating materials are durable. In fact, there is no reason why they should ever wear out under proper care, especially indoors. Therefore, after one or two years of use the steam saved is "pure profit."

This formula is applicable to flat or round surfaces. A good way in which to use the formula, therefore, is to compute the cost of the covering per square foot and in the formula insert "one square foot" for A. The relative values of the various sizes of coverings will thus easily be solved. Small pipe coverings usually cost more per square foot of surface covered and there-

fore it will take longer for the covering to pay for itself. This leads to the conclusion that large pipes, certainly, should be insulated against heat loss.

It will be readily understood that a formula of this kind cannot apply equally well indoors and out. The temperature difference is generally much greater out-of-doors, and the radiating effect is also greater on account of the more serious nature of the air currents. A wintry blast against a hot steam pipe is notorious as a money waster. I therefore wish to impress upon the minds of readers that in applying this formula to out-of-door conditions it can be correctly assumed that the coverings will pay for themselves much more quickly than the result will indicate. The greater the temperature difference and the more rapid the air currents the more necessary the insulation.

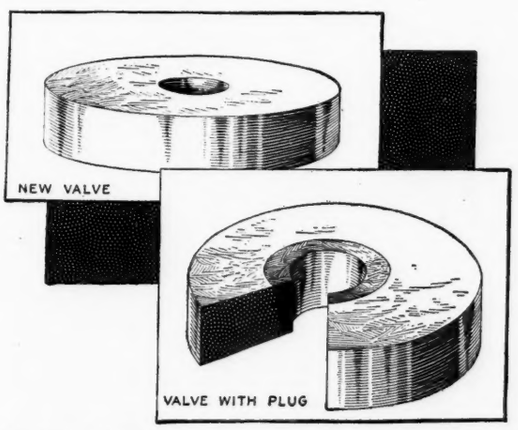
The formula also shows that a high boiler efficiency will increase the number of hours (H), whereas a high efficiency of the covering will decrease the number of hours. It furthermore shows, of course, that a good inexpensive covering is most desirable. It is probably true, in extreme cases, that covering doesn't pay; but by applying this formula carefully it is my belief that such cases will seldom be found.

Keeping Rubber Valves in Service

BY TIMOTHY RYAN
Hazleton, Penn.

The following is a method whereby increased service can be secured from rubber pump valves. I have had considerable trouble with valves of this kind and they became an expensive item of repairs.

The hole in the valve becomes enlarged, due to the friction of the valve stem, and practically new valves would have to be cast aside as the hole in the center would allow too much water to pass through it. I have overcome this difficulty with a rubber bushing. To do this I take a valve with a large hole and punch the hole somewhat larger; then take an old valve that is of no use and punch a piece from it to fit the hole in the valve



METHOD OF REPAIRING WORN RUBBER VALVES

to be used again. This makes a blank valve. The hole in the center can now be made of a size to fit the valve stem. Before placing the enlarged plug in the valve, I, of course, apply a little rubber cement.

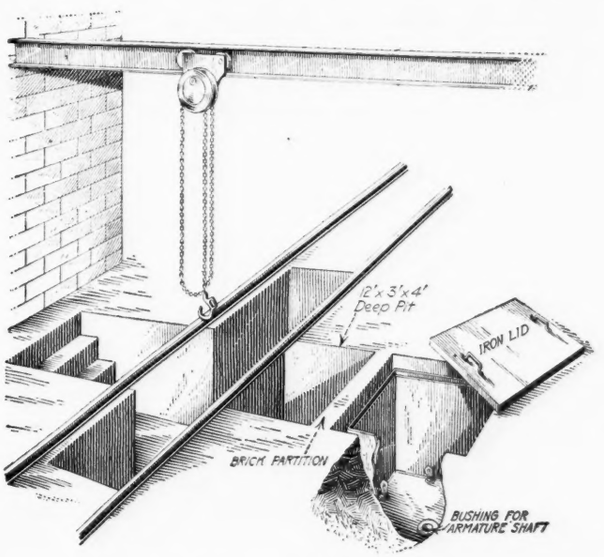
When the hole in the center of a bushed valve becomes too large, the center can be replaced by another bushing with a smaller hole.

By this means valve stems that are worn small can be kept in service. Thus if the original size of the stem was $\frac{3}{4}$ in. and it wears down to say, $\frac{5}{8}$ in., the stem hole in the center of the valve can be punched $\frac{5}{8}$ in. I have tried this method for several months and find it works quite satisfactorily.

Homemade Armature Oven

BY R. Z. VIRGIN
Wheeling, W. Va.

At the ordinary mine plant there is no oven built or provided wherein the electrician may bake the armatures after winding. A homemade oven, similar to the one shown in the accompanying illustration, may be used



REPAIR PIT AND ARMATURE OVEN

for this purpose; while the idea is not new, it perhaps has not been thought of in some localities.

Above is shown the side wall of the building, with an "I" beam across the motor pit, on which runs a trolley carrying a set of chain blocks which are used to lift wheels, armatures, etc. At one side the pit is extended and partitioned off with brick or cement. This portion of the extension is of noncombustible material and is 48 in. long, 48 in. wide and 40 in. deep. Into this fits a box 30 x 36 in. and 36 in. deep, lined with sheet asbestos $\frac{1}{8}$ in. thick. Inside the box are placed eight carbon lamps, 16-cp., 250 volts. In the bottom of the box is a bushing or step bearing long enough to accommodate the armature shaft and take its weight. This keeps the armature upright.

After the armature is wound, it is taped on the ends to keep the varnish off, and submerged in a tank of baking varnish, just up to the commutator. It is then drained off and allowed to stand and drain for 24 hours, after which it is placed in the oven and baked for 36 to 48 hours. If a second coat is desired the same process is repeated. A box of this size will accommodate armatures of about the size generally used in a 15-ton locomotive.

Bettering Coal by Heat and Pressure*

BY CHARLES T. MALCOLMSON
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SYNOPSIS — *The coal is distilled at a low temperature. The semicoke thus obtained is mixed with pitch obtained from that distillation. It is then briquetted and subjected to a further distillation at 1800 deg. F. More tar, oils and ammonium sulphate are obtained than when coking coal in the byproduct coke oven.*

AN ELABORATE series of experiments has been conducted during the past three years at Irvington, N. J., which has resulted in the perfecting of a process for the manufacture of smokeless fuel from high-volatile coals, and for the recovery and refinement of the coal-tar products derived therefrom. These experiments have been financed by Blair & Co., of New York, and were conducted under the direction of Charles H. Smith, the inventor of the process.

The low-temperature distillation of coal has interested investigators for many years. Sporadic attempts have been made to solve the mechanical problems, but until the Smith process was developed they were not carried to conclusions of economic value. The present coal shortage and the increasing demand for smokeless fuels make this subject one of timely interest.

DESCRIPTION OF PLANT

The following equipment was installed and operated during the experimental period: Four horizontal and two vertical units of commercial size for the low-temperature distillation of the coal; two vertical, two horizontal and two inclined benches for distillation of the briquets at medium and higher temperatures; presses and auxiliary equipment necessary for making briquets; and a complete byproduct recovery and tar-refining plant. This commercial equipment is provided with gas and electric meters, pyrometers and other apparatus for recording accurately the results of all experiments.

There is, in addition to the commercial equipment, a complete chemical laboratory with distillation and recovery apparatus, including facilities for refining and cracking the tar and measuring the yields and calorific value of the gas. This apparatus makes it possible to study on a small scale the various problems involved in the process.

DESCRIPTION OF PROCESS

Mr. Smith's experiments have resulted in the production on a commercial scale of: (1) A fuel, called "carbocoal," which, for convenience in handling, is prepared in briquet form. (2) A yield of tar more than double that obtained in the ordinary byproduct coking process. (3) Ammonium sulphate in excess of that normally recovered in the ordinary byproduct coking process. (4) Gas, in amount approximately 9000 cu. ft. per ton of coal carbonized, which is at present used in the process.

The essential features of the Smith process are the two distillations carried on at different temperatures, first of the raw coal and second of the raw briquets. The raw coal, after being crushed, is distilled at a relatively low temperature, 850 to 900 deg. F., and the volatile contents are thereby reduced to the desired point. The result of this first distillation is a large yield of gas and tar, and a product rich in carbon, termed "semi-carbocoal." The semi-carbocoal is next mixed with a certain proportion of pitch obtained from the tar produced in the process, and this mixture is

*Paper entitled "Carbocoal," to be read at the Colorado meeting of the American Institute of Mining Engineers, September, 1918.

briquetted. The briquets are then subjected to an additional distillation at a higher temperature, approximately 1800 deg. F., resulting in the production of carbocoal, the recovery of additional tar and gas, and a substantial yield of ammonium sulphate.

The characteristic feature of the primary distillation is that it is continuous and that the coal is constantly agitated and mixed during the entire operation. This is accomplished by a twin set of paddles which also advance the charge through the retort. By this means, all portions of the charge are uniformly distilled, and by controlling the speed at which the charge moves through the retort the distillation may be arrested at any desired stage. As only a partial carbonization is permitted in the primary distillation, the hard metallic cells characteristic of coke are avoided. The period of distillation is one to two hours, and the continuous retort has a carbonizing capacity of one ton of coal per hour.

In the subsequent distillation of the briquets, all evidence of the pitch as a separate ingredient disappears. There is a marked shrinkage in the volume of the briquet, with a corresponding increase in density, but no distortion of its shape. This distillation requires four to five hours and is performed in an inclined, self-charging and self-discharging bench.

The carbocoal represents more than 72 per cent. of the weight of the raw coal, the exact percentage depending upon the volatile content of the latter.

Carbocoal is dense, dustless, clean, uniform in size and quality, and can be readily handled and transported long distances without disintegration. It is grayish black in color, slightly resembling coke, but its density more nearly approaches that of anthracite coal. It is manufactured in briquet form and can be made in any

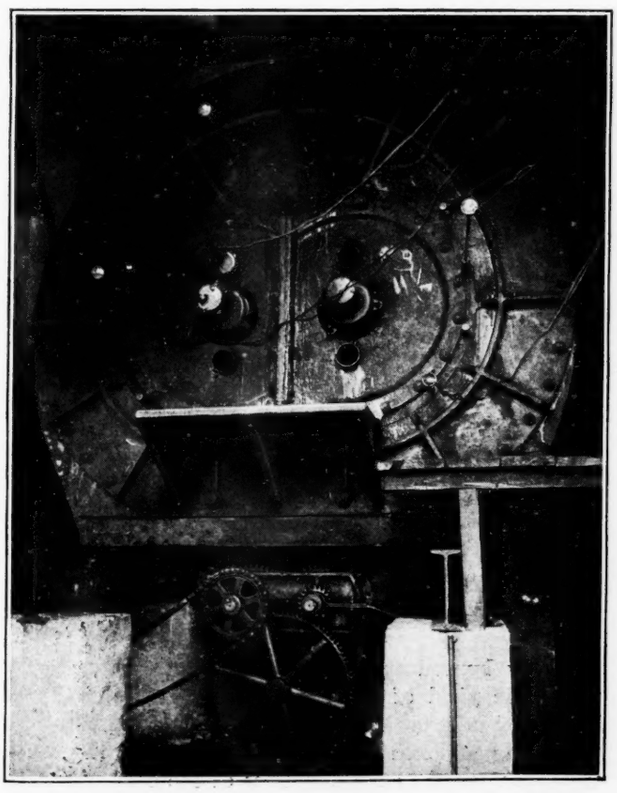


FIG. 1. DISCHARGING END OF A PRIMARY RETORT

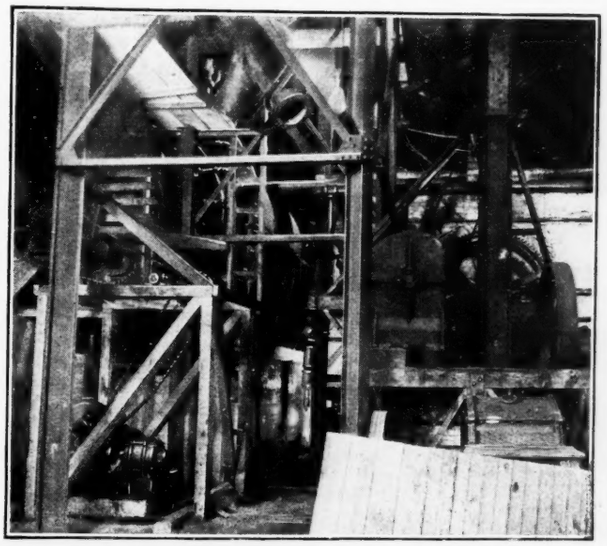


FIG. 2. WHERE COAL IS CHARGED TO PRIMARY RETORTS

size, from ½ oz. to 5 oz. The larger sizes are better suited to locomotive purposes, and the smaller sizes for domestic use.

Heretofore, devolatilized fuels, such as coke, have not attained the high rates of combustion desired for locomotive, marine and general steam purposes; and their greater displacement has operated against their general use where transportation cost or stowage space has been an important factor. Carbocoal overcomes these objections. It is actually a relative soft but tough form of carbon, readily attacked by oxygen in combustion; and for this reason, requires much less draft than other high-carbon fuel.

Carbocoal has been tested by the Long Island R.R.; by the Pennsylvania R.R. at its testing plant at Altoona; by the Carolina, Clinchfield & Ohio R.R.; and by the United States Navy.

These tests have demonstrated that the fuel is smokeless. At a combustion rate of 100 lb. per hour on each square foot of grate surface it has evaporated 8.5 lb. of water, from and at 212 deg. F., per pound of fuel fired. At the lower combustion rate of 27 lb. per hour on each square foot of grate surface it has evaporated 12.8 lb. of water, from and at 212 deg. F., per pound of fuel fired. It has been demonstrated also that it requires no greater draft than bituminous coal. A maximum combustion rate of 166 lb. per hour on each square foot of grate surface has been reached for a short period.

Carbocoal has been found particularly suitable for the following purposes: (1) Marine and locomotive service, where limited grate area and restricted boiler capacity demand efficient fuel; where smoke is objectionable or dangerous, as in the case of ships in time of war. (2) Stationary boilers, where smoke pollution of the air is offensive and dangerous to health. (3) Domestic uses, including furnaces, stoves, ranges and open grates, where cleanliness is a desirable factor. (4) Kilns, drying and roasting ovens, and all purposes where an intense and uniform heat is desired. (5) In metallurgical furnaces, as a substitute for coke. (6) Gas producers.

Carbocoal has been subjected to practical tests in

household use for over a year. It fulfills all the requirements of a domestic fuel. It can be burned satisfactorily without change of furnace or grates, and it responds readily to changes in draft. The uniformity of combustion, absence of fines, even distribution of ash, and absence of clinker as compared with the coal from

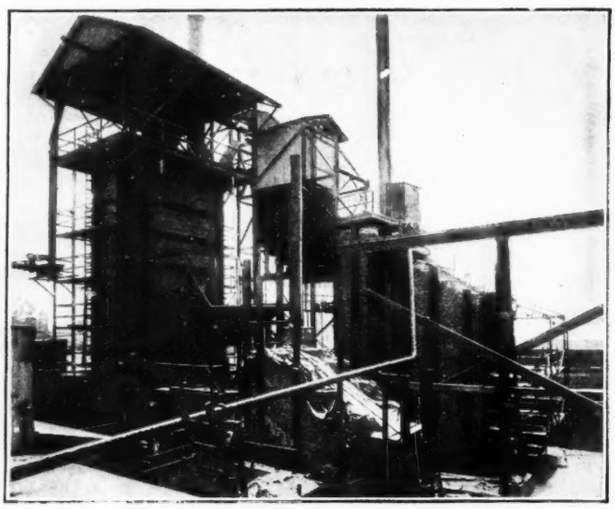


FIG. 3. INCLINED BENCHES FOR CARBONIZED BRIQUETS, KNOWN AS SECONDARY RETORTS

which it is made, are additional characteristics in favor of this fuel. Tests have demonstrated that carbocoal can be banked satisfactorily overnight, requiring no more attention, and with no greater consumption, than anthracite.

Carbocoal is compressed into briquet form to obtain maximum density, to minimize transportation costs and the losses incident to handling; and to secure the efficiency of combustion resulting from uniformity of size. Briquets of bituminous and anthracite coals have been manufactured for many years. Such briquets are made from the smaller sizes or screenings of coal, with the addition of a binder, such as coal-tar pitch. In carbocoal, however, an entirely new product is obtained, differing from the original coal in chemical and physical properties. The briquets contain no binding material to soften or disintegrate in the fire. Carbocoal must therefore be recognized not as a mixture, but as a new product, the result of a process of manufacture.

The amount of ash and sulphur in the carbocoal depends upon the characteristics of the coal from which it is made. The summarized proximate analyses of carbocoal, manufactured from 25 different coals at the Irvington plant, are shown in Table I.

The percentage of byproducts recovered from clean coal is greater than that recovered from high-ash coals;

TABLE I. ANALYSES OF CARBOCOAL

	From Run-of-Mine, Per Cent.	From Washed Coal, Per Cent.
Moisture	1.00 to 3.00	1.00 to 3.00
Volatile matter	0.75 to 3.50	0.75 to 3.50
Fixed carbon	82.00 to 88.00	85.00 to 90.00
Ash	8.50 to 12.00	7.00 to 10.00
Sulphur	0.5 to 1.50	0.6 to 1.50

therefore the careful preparation of the raw coal by washing or other means is profitable.

The total yield of tar by the carbocoal process is large. Coal containing 35 per cent. volatile combustible produces more than 30 gal. of water-free tar per short ton. The tar products recovered from the distillation of the coal, at the low temperature used in this process, are different in nature from those obtained in other processes where high temperatures are used. At the lower temperature, there is an abundance of tar vapors and a relatively small yield of gas of high illuminating value. At the higher temperature these primary products are split up, with a consequent increase in the gas yield and a corresponding decrease in its illuminating value and in the amount of tar vapors recovered. There is also an increase in the percentage of residuals, the pitch increasing from 30 per cent. in the low-temperature distillation, to 64 per cent. or more when high temperatures are used.

The tar obtained in the primary distillation of the coal has a specific gravity of 1.00 to 1.06. It contains a large percentage of light solvent oils, tar acids and cresols, but very little carbolic acid and no naphthalene or anthracene. The free-carbon content of this tar is low. The light oils contain appreciable quantities of naphthenes, pentane, hexane, hexahydro-benzenes, and also hydrocarbons of the paraffin series, which make these oils valuable as a substitute for gasoline.

A satisfactory method of removing the paraffin and aromatic portions of the light oil has been developed, so that chemically pure (or rather c. p.) benzol and toluol can now be obtained by this process. During the low-temperature distillation period, 20 to 28 gal. of tar, including the light oil obtained from the stripping of the gas, are recovered, the exact amount depending upon the volatile content of the coal. This low-temperature tar contains approximately 30 per cent. of pitch and 70 per cent. of tar oils, as compared with 50 to 60 per cent. of pitch and 40 to 50 per cent. of oil products contained in ordinary gas-house and coke-oven tar. In the second or high-temperature distillation, 5 to 6 gal. of tar are added to the above yield. This tar is heavier than that obtained from the first distillation, and is similar to coke-oven tar.

Table II compares the tars and light oils obtained in the production of carbocoal with those obtained in the

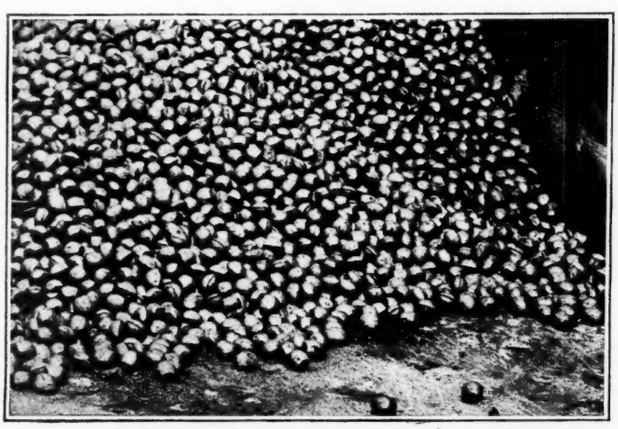


FIG. 4. RAW BRIQUETS MADE FROM SEMI-CARBOCOAL

ordinary byproduct coking processes. In addition to the above yield of tar there is obtained, in both the byproduct coke oven and the carbocoal process, by stripping the gas, from 2 to 3 gal. of light oil. This yield depends upon the characteristics of the coal carbonized. Approximately 30 per cent. of the fraction from 170

to 360 deg. F. in the carbocoal process are tar acids; the remainder of the fractions are neutral oils. The value of the products from the distillation of tar depends, of course, on the extent to which the tar is refined. The fractionation and subsequent treatment of the tar oils, which is a part of this process, give the products shown in Table III, for the carbonizing of 1000 tons of coal; the figures are based upon data obtained from carbonizing run-of-mine coal from Clinchfield, Virginia.

TABLE II. RECOVERY OF LIQUID PRODUCTS PER TON OF RAW COAL CARBONIZED

	Distillation Temperature, Deg. F.	By-product Gal.	Coke Oven Per Cent.	Carbocoal, First Distillation Gal.	Carbocoal, First Distillation Per Cent.	Carbocoal, Second Distillation Gal.	Carbocoal, Second Distillation Per Cent.
Light oil	0–170	0.27	3.47	1.58	6.60	0.003	0.05
Middle oil	170–230	0.44	5.85	3.29	13.70	0.036	0.60
Creosote oil	230–270	0.78	10.37	3.11	12.95	0.126	2.10
Heavy oil	270–360	1.26	16.81	8.88	37.00	2.485	41.42
Pitch		4.66	62.18	6.90	28.75	3.290	54.83
Loss		0.09	1.32	0.24	1.00	0.060	1.00
Totals		7.50	100.00	24.00	100.00	6.000	100.00

Pitch is always an element of questionable value in tar distillation. The Smith process, however, utilizes all of its pitch for briquetting the semi-carbocoal produced by the first distillation. Moreover, the valuable portions of this pitch are recovered in the tar and gas resulting from the second distillation. It is therefore noteworthy that all the tar products recovered by this process are oil derivatives.

TABLE III. PRODUCTS OBTAINED FROM A THOUSAND TONS OF CLINCHFIELD, VA., COAL

1. Carbocoal of analysis hereinunder			725 tons
	Raw Coal	Carbocoal	
Moisture	0.72	1.84	
Volatile matter	35.01	2.75	
Fixed carbon	57.23	85.64	
Ash	7.04	9.77	
	100.00	100.00	
Sulphur	0.63	0.52	
2. Sulphate of ammonia			20,000 to 25,000 lb.
3. Other nitrogen products, principally, pyridine bases, approximately			2,000 to 4,000 oz.
4. Motor spirits			1,800 to 2,200 gal.
(or c. p. benzol, 250 gal., c. p. toluol, 500 gal., motor spirits, 1,000 gal.)			
5. Crude tar, acids principally cresylic acids			4,040 gal.
6. Water-white naphthas			3,500 gal.
7. Creosote oil			5,450 gal.
8. Heavy creosote oil			4,660 gal.
Other products, used in process:			
9. Pitch			10,000 gal.
10. Gas, of 530 B.t.u., approximately			9,000,000 cu.ft.

The primary distillation of the raw coal gives only a small yield of ammonium sulphate. The secondary distillation of the raw briquets, however, brings the amount up to approximately 21 lb. per short ton of raw coal carbonized.

In the primary distillation of the raw coal, from 5000 to 6000 cu.ft. of gas per short ton of coal is recovered. This has a heating value of 650 to 700 B.t.u. per cubic foot. The distillation of the briquets yields also about 4000 cu.ft. of gas of 350 to 400 B.t.u. per cubic foot. The process in its present stage of development uses all of the gas recovered from both distillations.

The illustration at the head of the article shows the carbonized briquets that are known as carbocoal.

Two of the most important conditions that make mechanical stokers successful in burning smoky coal without smoke probably are: (a) Slow and uniform heating of the coal with the result that a large part of the volatile matter is distilled at low temperature, and (b) distillation of the volatile matter occurs in the presence of oxygen.—*Bureau of Mines Bulletin No. 135.*

Prevention of Mine Explosions

BY JAMES ASHWORTH
Consulting Mining Engineer, Vancouver, B. C., Canada.

The following brief notes from the recent address of the president of the Monmouthshire District Association of Students in England, will be of interest in connection with the unsolved problem of preventing disastrous explosions of gas and dust in coal mines:

The disaster at Halmerend, North Staffordshire, is another tragic lesson to us that, in spite of all that has been done, we have yet no right to suppose that we have secured immunity from explosions.

Watering and stone-dusting may be made an effectual defence against the initiation and propagation of explosions in main roadways if the watering is continuous; or if steps are taken to insure that the stone dust is regularly applied and intimately mixed with the coal dust.

It is essential that the walls and roof should present a smooth surface, without projections or cavities in which coal dust and gas may lodge. But even when the roadways are rendered safe, there still remains the question of preventing explosions at the coal face. Here watering cannot be satisfactorily applied, and the coal dust is formed in such enormous quantities, and with such rapidity that effective stone-dusting may be generally considered to be impracticable. It is therefore worth considering, whether some totally new method cannot be discovered whereby the danger from coal dust may be entirely eliminated. . . .

SAFETY LAMPS—It would be well worth while trying to discover some sure and rapid method of detecting and estimating firedamp without the use of flame of any kind. This would permit of electric safety lamps, only, being used in the mine and would be another great step taken on the way to safety.

RESCUE APPARATUS—Here, there is also need of improvement. A short while ago Dr. Haldane made the startling and distressing statement that most forms of apparatus in use were little better than death traps. After a time, the oxygen in the breathing bag may reach a high temperature; and this, together with the weight of the apparatus, may be sufficient to produce exhaustion and collapse on the part of the rescuer, even in circumstances where without the apparatus the man would be safe.

Messrs. Corrie and Winborn, at the request of the Commission on Breathing Apparatus, have recently been investigating this point, and have found that, by introducing a quantity of sodium sulphate crystals into the breathing bag, the temperature may be kept sufficiently low to permit the rescuer to work without discomfort.

Sodium sulphate melts at a temperature of 34 deg. C., and, on melting, extracts its latent heat of fusion from the oxygen and thereby keeps the temperature in the bag low, which is a most interesting direct and simple application of pure science to a practical problem.

These subjects offer quite a large field for discussion and investigation. There are many weak points in the different types of mining equipment in use today, and these require constant study to ascertain if possible how to improve them.

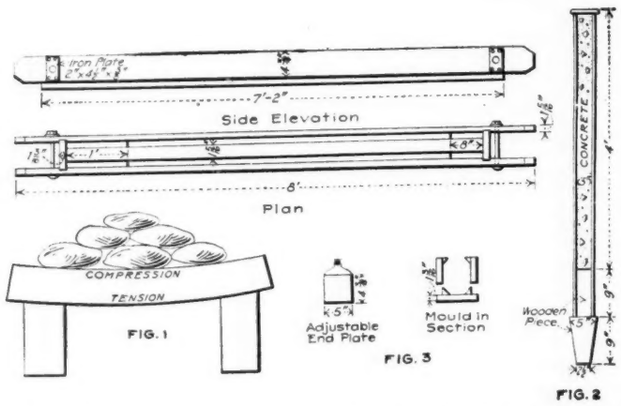
Concrete in Coal Mine Service

By J. F. SPRINGER
New York City

SYNOPSIS — *Concrete is being used more and more about mines, replacing less permanent construction materials. Unfortunately concrete possesses low tensile strength. This may in part be rectified by suitable reinforcement. In order to be dense and strong sufficient sand only should be used in concrete to fill the voids in the crushed rock or gravel; enough cement should be used to fill the voids in the sand.*

IT WILL be wise for coal-mine officials having little or no knowledge of concrete to familiarize themselves with its qualities in advance of committing themselves to its use. They will then be better able to see exactly where it can be used to advantage and where its use would probably lead to disappointment.

Concrete is a splendid material in its proper place. There are many ways in which coal mines may employ



FIGS. 1 TO 3. CONCRETE BEAM, MINE PROP AND DETAILS OF WOODEN FORM

it with economy and satisfaction. Some of these are now being taken advantage of while others are being developed. Other uses await discovery through the inventive and adaptive ability of coal-mine officials. It is so important, however, to have a just conception of the character of concrete that no apology or further explanation will perhaps be necessary to justify a brief statement of its qualities.

Concrete is strong in compression. That is, it will endure heavy pressure tending to squeeze its mass together. But it is weak in tension. It is therefore ill-adapted to resist stresses tending to pull its particles apart.

There is, however, a corrective for this weakness. Steel possesses in high degree the quality lacked by concrete. Furthermore, its coefficient of linear expansion is nearly the same as that of concrete. Steel may be regarded as having a coefficient of 0.0000066 for each degree Fahrenheit. Concrete has a coefficient of 0.0000055. This fact makes it possible to employ this metal to supply what concrete lacks. That is to say, properly reinforced concrete possesses considerable tensile strength. Naturally, however, such concrete is more expensive than that made without reinforcement. While ultimately highly rigid, concrete may be molded or cast in a great variety of sizes and forms. This constitutes a great advantage over other masonry and is one of the chief reasons for the tremendous popularity of this material with construction engineers. This quality ought to recommend it for mine use.

Concrete is highly indestructible. It cannot be said that no fire, however hot, will break it down; but it is one of the most highly fire resistant materials in use for construction purposes and a favorite with fire insurance companies. It is also age-resisting. I am not one of those enthusiasts, however, who claim that it will resist forever the vicissitudes of wind, storm, water, ice and climate. The consideration that claims similar to this can not be quickly disposed of is significant of age-resisting power.

Concrete is, when properly employed, easy to maintain. This is one of the chief reasons why concrete roads are now enjoying such popularity. There is no necessity for keeping a concrete structure painted. This is a great advantage.

One highly valuable quality of concrete relates to the ease of its manufacture. Everything but the ingredient used in the smallest quantity is ordinarily obtainable at or near the point of use. It can quickly be made and poured, and a minimum of skilled attention is necessary. In a short time after pouring it is usable. In other words, concrete lends itself to rapid and economical construction.

Standardized Units Tend to Lower Cost

There is, however, some modification necessary to make this statement generally true. The cost of forms is sometimes a serious matter tending to hinder the use of concrete. This objection is being met, in part, by an increasing standardization of constructional units. Thus knockdown forms may be made and used over and over again.

When concrete is used in considerable masses without reinforcement it is often possible to reduce its cost per cubic yard by the use of what are called "plums." These are simply sound rocks, properly freed from dirt and loose pieces, which are buried in the ordinary concrete. These may cost little. They replace equal volumes of what is usually a material costing much more money largely because of the necessary presence of portland cement.

Concrete is suited to a variety of methods of local transportation, after mixing, to the point of use. These are generally rather inexpensive methods. In short, concrete is usually cheap to place. It can be taken from the mixer to the place of its final use in a wheelbarrow, a hand bucket, a steel bucket of large size handled by a mule team, an auto-truck or tramway locomotive, or raised, lowered and swung by a derrick. Or a hoisting engine may handle a bucket or wheelbarrow between levels.

Concrete may be dispatched after mixing by means of

a closed or open chute operating by gravity, as shown in Fig. 5. Or it may be transported over horizontal distances running up to 1000 ft. through a pipe line, the drive being effected by compressed air. For shorter distances, a patented method of using steam is available. Further it may often be dispatched below ground by simply dropping batches of the dry ingredients down a vertical pipe to a mixer below, where the actual final mixing may take place.

Concrete may be mixed and placed in all weathers, though special precautions may be necessary in winter. Concrete may be placed in the open air or under water. There is now no great difficulty in successfully pouring concrete beneath water, although until recently this could hardly have been said. And I do not say that this can now be done without proper precautions. But what to do and how to do it are no longer unknown. As witness of this statement, I cite the placing of the concrete envelopes around the submerged steel tunnels in the Detroit River and in the Harlem River.

The use of concrete as a protective covering for steel is approved practice. This differs from the use of the two materials in the form of reinforced concrete. In the latter case the concrete is the principal constituent, the steel acting as a supplementary substance. In the former the steel construction is built and designed to perform the duty required, but needs protection from agencies which would tend to impair or destroy its usefulness. An overhead girder may, for example, be constructed of steel and may in this condition, without the addition or subtraction of anything else, be quite capable of sustaining the load placed upon it, provided the steel does not rust and is not injured by the heat from some accidental fire near-by. Concrete in such a case provides an envelope suited to protect against both the evils mentioned.

I have, so far, been dealing mostly with the good qualities of concrete. It may be well now to consider some of the qualities which concrete possesses either not at all or only in moderate degree. Thus, while concrete is admirably adapted to withstand the action of water, it is not readily made impervious to water, especially when it is under a considerable head. This consideration may or may not be important, depending upon the purpose for which the concrete is to be used. Where considerable heads are encountered the preventive practice seems to be now tending toward the addition of a protective covering of other materials.

Concrete may be made resistant to the penetration or percolation of water, whether under a head or not, by various means, but chiefly by increasing the density of the concrete itself. Again, concrete is well adapted to resist the wear and tear of the traffic on country roads; but this must not be magnified to the point where the traffic becomes not only excessively heavy in its amount but excessively severe in its action. In such cases the approved practice is to add a wearing surface of another material, superimposing this on the concrete foundation.

Again, concrete exposed to frequent alternations of freezing and thawing or of salt water and sunshine has in the past proved rather deficient. But even this difficulty is being surmounted, not so much by modifying the general mass of the concrete itself as by using an extremely dense exterior layer of concrete or cement mortar.

Again, the rigidity of concrete makes it ill-adapted for some uses though well suited to others. Thus it is not considered advisable to construct piers with concrete floor where the foundations of the pier are subject to uneven subsidence. The same objection would apply to concrete props in a coal mine unless the vertical rigidity of the prop can be reduced. There is some reason to expect that this can be done, as will be mentioned later. Wood props yield a bit and, as the stress rises toward breakage, they give notice of approaching failure. In short, they do not give way after the manner of a sudden collapse.

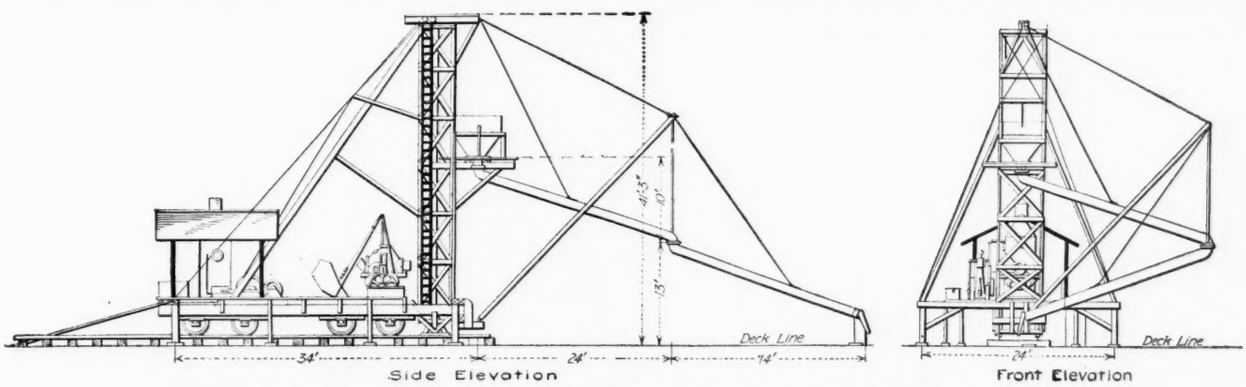


FIG. 4. SIDE AND FRONT ELEVATIONS OF MIXER AND CHUTE ILLUSTRATED IN FIG. 5

In Great Britain the coal-mining industry is confronted by excessive prices for wooden timbering. Naturally attention has been directed toward concrete. The cross bar of the ordinary three-piece set is essentially a girder or beam. The service to be performed is by no means a new one for concrete—that is, reinforced concrete. This case is that of a simple beam supported at its ends and loaded on top. It is thus subject to two kinds of stress. The load brings about deflection. On the top side the material is under compression while on the under side the beam is under tension (see Fig. 1). It is assumed that all the upper part of a beam is stressed in compression and that all the lower part is stressed in tension, and that the two parts are separated by a horizontal plane or by some other mathematical surface where there is neither compression nor tension. This is the neutral plane or neutral axis (if only a vertical section be considered).

Applying this analysis to the construction of a concrete mine bar, it is easy to understand that the steel

reinforcement should be located mainly in the lower half since this is the region where the concrete is unable to bear the tensile stresses. If the longitudinal reinforcement were evenly disposed, so that there were as much in the upper part of the beam as in the lower part, there would be a waste of steel. It is necessary for reasons of economy that the compression strength of concrete should be utilized. This means that little reinforcement need be used in the upper part of the beam, the bulk of it going into the lower part to perform the service that the concrete cannot perform. However, in the manufacture of bars and in their transport to the point of use, also in their handling during installation, the bars may be put under tensional stresses on all faces. Accordingly, it will not be advisable to go to the extreme of leaving any faces absolutely without reinforcement.

It is advisable to call attention to one matter. If bars are reinforced so as to resist tension on one side or face, they should be plainly marked or suitably shaped so as to indicate easily which side or face this is. Otherwise a bar made to sustain a given load might fail because of improper installation. The prop, whether used alone or as a support for a cross bar, must either itself yield or be conjoined with something that will. Offhand the concrete prop does not seem adapted to mine service. But one mining concern, the Haunchwood Collieries, has 5000 reinforced concrete props in use. These particular props are reinforced by four pieces of ½-in. wire rope. Generally they are octagonal in section and have a diameter of 5 or 6 in. The length is usually 6 ft. The cost, in England, is understood to have been about 5 or 6c. per linear foot of prop. The concrete is made of washed granite. The cost includes labor and material. The extreme lengths in use run up to 7½ ft. "They stood well where there was top pressure only, but where there was a side weight they were liable to crack. Even then, however, they gave warning, and before the crack had fully developed there was time to substitute another prop. They were tried in the face in front of the packs, but only where there was a soft bottom; it was of no use putting them where the bottom was hard. They had a good cap piece on the top, and the soft clay bottom allowed the prop to push its way downward. In the face, however, they invariably broke if any heavy lumps rolled up against them. Props were tried reinforced by four wire rods, but they did not seem to stand compression as well as those reinforced with wire rope. The wire rods were not brazed together in any way." These props were not proof against hammer blows.

I give this experience with concrete props to show that they are practical. It must not be understood, however, that I am indorsing the use of wire rope for reinforcement. That reinforced concrete can be made to resist severe shocks will be readily granted perhaps when I call attention to the fact that thousands of reinforced-concrete piles have been driven by hammer action. In most cases, however, the hammer effect was somewhat cushioned. Nevertheless there must have been a severe shock in order to get penetration.

It is proposed to use a system of reinforcement where longitudinal rods are welded to "triangular bracing" when manufacturing props. To get the yielding effect a base or cap for the bottom or top respectively might be used. This base or cap is provided with a suitable bearing surface to come into contact with the earth or rocks. The prop fits into a deep depression in the opposite face and becomes a kind of piston or ram. The cavity is partially filled with clay or some similar plastic material. With the prop pressing against this clay-like substance the necessary yielding effect might be secured by means of one or more small holes piercing the wall of the cavity. The base or cap may be made of concrete, cast iron or steel. If used as a cap instead of a base, it is easily recoverable after its service has been performed.

FIG. 5. GRAVITY CHUTE FOR DISPATCHING MIXED CONCRETE

Experiments made under a hydraulic press with a cast-iron base or cap and a stiff clay filling showed that a pressure of 23 tons (2240 lb. each) required 14½ minutes to produce a subsidence of $\frac{1}{16}$ in. when the outlet hole in the wall of the cavity was $\frac{3}{32}$ in. in diameter. It is understood that the diameter of the cavity was 5¼ in., thus giving a surface of about 21 sq.in. and a load of about 2450 lb. per square inch. Naturally the stiffness of the clay and the diameter of the outlet have a strong influence and furnish means of getting variations. These are provisions for introducing the yield. They are not always necessary, as

would seem to be indicated by the case of the Haunchwood Collieries.

A mine prop has been proposed which is constructed of steel tubing, wood and concrete (see Fig. 2). A representative case may be taken as a prop 5½ ft. long and 3¾ in. in diameter. The tube for this prop may properly be 3 in. inside diameter, thus giving a wall thickness of ⅜ in. The length is taken at 4¾ ft. This tube is filled with concrete except for a distance of 9 in. at one end. There will thus be 4 ft. of tube filled with a solid core of concrete and 9 in. empty. A wooden piece 18 in. long is now cut from a round stick 5 in. in diameter. Amidships a shoulder is arranged and 9 in. of the piece is reduced in diameter to fit into the tube. The remaining 9 in. is tapered to suit the probable service—say, for example, that a conical taper is made by reducing the diameter, in the 9-in. length, from 5 to 2½ in. This wooden piece is fitted into the open end of the tube. A crown or cap of any desired kind may be put on at the other end. The prop is now ready for service.

A mixture following the formula 1:1½:3 is suggested as suitable for the concrete filling. This seems unnecessarily rich. If a more moderate mixture is desired, the formula 1:2:4 or 1:3:5 would be suitable. Instead of a conical taper a wedge form may be used. When in service an excess load causes the wood tip to burr or broom. The tip thus saves the prop itself from destruction. It was stated about two years ago that there were several hundred of these props in use and that some had been set 30 or 40 times and that there had not been a single one lost.

A method of manufacturing a nontapered all-concrete prop has been worked out in England approximately as follows: A wooden form of collapsible construction is given a maximum length of, say 8 ft. (see Fig. 3). This will enable a prop to be given a maximum length of about 7 ft. Shorter lengths can be made with the same form. The prop is octagonal in section. The distance between opposite faces of the octagonal prism is 4¾ in. The size of the prop may be taken as roughly equivalent to that of a round one 5 in. in diameter. The assembled form is held together by bolts and will easily strip from the concrete prop as soon as these bolts are removed. The boards should be well greased or otherwise safeguarded against sticking to the concrete. Probably crude vaseline thinned with kerosene would be as suitable a grease as any. However, crude oil, linseed oil and soap solution are all usable.

Simpler to Use C-Clamps Instead of Bolts

In order to provide for shorter lengths the wooden strips may be slotted at proper points and a metal diaphragm slipped into the slots. Where a considerable number of props are to be made it will perhaps be found simpler to use C-clamps instead of bolts. In any case it may be found desirable to hold the form in the center as well as at the ends.

Mine props made abroad have been poured from concrete made on the formula 1:1¼:2¼. The fine aggregate was "cracker granite dust" instead of sand. This probably corresponds to our crusher dust. The coarse aggregate was clean ashes. I am reporting the ingredients and the proportions, not indorsing them. These things must stand or fall upon test. Most props were made hexagonal, the diameters being 3¾ to 4½ in., and the lengths 4½ to 6½ ft. A 6-ft. prop, ready for service, would weigh some 80 lb. Wire rope, to the average amount of about 7 lb. per prop, was used for reinforcement. Three or four strands were employed. Apparently the size of the strands was about ⅜ in. They were set about 1½ in. apart and kept so by wire. First concrete would be poured in until a layer 1 in. thick covered the bottom of the form. Then the wire arrangements to hold the rope strands were set.

It might be well for American operators and manufacturers to try out this idea of using old wire rope for reinforcement. It seems to have had a measure of success abroad. According to ideas prevalent here—and abroad too—a rope reinforcement is peculiar. It appears that the ropes are not always laid parallel but are sometimes crossed.

Ratio of Sand to Coarse Aggregate

As to concrete itself, whether used for props, bars or something else, the fundamental principle underlying the proportioning of the ingredients is that the cement combined with water shall be sufficient to fill all voids left in a mix of the sand and coarse aggregate. There is only the one binder. If it does not fill the interstices, then the concrete will necessarily be porous; and porosity may be taken to mean reduction in strength as well as in impermeability. Thorough mixing is good concrete practice, but no amount of mixing will take the place of cement.

As coal mines will probably want to use a considerable variety of aggregate, because of local convenience, it may be well to say a word or two on determining the ratio between the sand and the coarse aggregate that are to go into the concrete. The following principle may be taken as a guide. Use such relative amounts of sand and coarse aggregate as will produce a compact mass. A tentative ratio may be determined as follows: First put a known bulk of the coarse aggregate into a water-tight vessel. Then pour in measured quantities of water until the voids are all filled and the water is even with the surface of the material. The ratio between the two volumes will be the tentative ratio desired, the water corresponding to the sand. Next mix the sand and coarse aggregate in these proportions, using the mixer that is to do the actual work. Imitate the rate and period of turning that are later to be employed. Then see if the dry mix is really compact. If not, vary the amount of sand or coarse aggregate until compactness is secured. Water may be used with this mixture to determine tentatively the relative amount of dry cement to use. Then test out this relative amount. Probably more cement will be needed in order to cover the imperfections in mixing. The foregoing directions are based on the assumption that what is wanted is a thoroughly compact, strong concrete. Where porous concrete is permissible less care may be exercised.

Some years ago specifications for sand used to require that it be clean and sharp. It is still necessary or advisable that sand be clean. Otherwise, we have material present which will prevent the binder—the cement—from filling all the voids and coming in contact with the surfaces of sand and coarse aggregate. As to sharpness, no attention need be paid to it, since there appears to be no substantial reason to expect that angular particles of sand will make better concrete than rounded particles.

Determination of Sulphur in Coal

By EDWIN M. CHANCE
Formerly Consulting Engineer, Philadelphia, Penn.*

SYNOPSIS—*Precautions needed to secure a correct evaluation of the sulphur in coal and coke which can not be obtained unless all the needed precautions are taken. Artificial gas used in the conduct of the analysis is apt to be absorbed by the Eschka mixture.*

THE following is the method adopted by the American Chemical Society and the American Society for Testing Materials in the determination of sulphur in samples of coal and coke along the lines of the Eschka method:[1]

Apparatus—The following apparatus should be provided: Gas or electric muffle furnace or burners for igniting coal with the Eschka mixture and for igniting the barium sulphate; porcelain, silica or platinum crucibles for igniting coal with Eschka mixture; No. 1 Royal Meissen porcelain capsule, 1 in. deep and 2 in. in diameter which, because of its shallow form, presents more surface for oxidation and is more convenient to handle than the ordinary form of crucible; No. 0 or 00 porcelain crucibles or platinum, alundum or silica crucibles for igniting the barium sulphate. No. 1 Royal Berlin porcelain crucibles of shallow form and platinum crucibles of similar size may be used in place of the No. 1 Royal Meissen but owing to the deeper form somewhat more time is required for the burning out of the coal.

Solutions and Reagents—The solutions and reagents are as follows: Barium chloride solution, made by dissolving 100 g. of barium chloride in 1000 c.c. of distilled water; saturated bromine water, made by adding an excess of bromine to 1000 c.c. of distilled water; Eschka mixture, made by thoroughly mixing two parts by weight of light calcined magnesium oxide and one part of anhydrous sodium carbonate, both materials to be as free as possible from sulphur; methyl orange made by dissolving 0.02 g. of methyl orange in 100 c.c. of hot distilled water, the solution being filtered; hydrochloric acid solution, made by mixing 500 c.c. of hydrochloric acid of specific gravity 1.20 with 500 c.c. of distilled water; normal hydrochloric acid made by diluting 80 c.c. of hydrochloric acid of specific gravity 1.20 to one liter with distilled water; saturated sodium carbonate solution containing approximately 60 g. of crystallized or 22 g. of anhydrous sodium carbonate in 100 c.c. of distilled water; sodium hydroxide solution made by dissolving 100 g. of sodium hydroxide in one liter of distilled water. This solution may be used in place of the sodium carbonate solution.

Preparation of Sample and Mixture—Thoroughly mix on glazed paper 1 g. of coal and 3 g. of Eschka mixture. Transfer to a No. 1 Royal Meissen porcelain capsule 1 in. deep and 2 in. in diameter or to a No. 1 Royal Berlin crucible or to a platinum crucible of similar size, and cover with about 1 g. of Eschka mixture.

Ignition—On account of the amount of sulphur contained in artificial gas, the crucible shall be heated over an alcohol, gasoline or natural-gas flame as in procedure (a) below, or in a gas or electrically heated muffle, as in procedure (b) below. The use of artificial gas for heating the coal and Eschka mixture is permissible only when the crucibles are heated in a muffle.

a. Place the crucible in a slanting position on a triangle, and heat it over a very slow flame to avoid a rapid expulsion of the volatile matter, for any such speedy volatilization tends to prevent complete absorption of the products of combustion of the sulphur. Heat the crucible slowly for thirty minutes, gradually increasing the temperature and stirring until and after all black particles have disappeared, which is an indication of the completeness of the action.

b. Place the crucible in a cold muffle and gradually raise the temperature in about one hour between 870 and 925 deg. C. (cherry-red heat). Maintain the maximum temperature for about 1½ hours and then allow the crucible to cool in the muffle.

Subsequent Treatment—Remove and empty the contents into a 200 c.c. beaker and digest it with 100 c.c. of hot water for ½ to ¾ hour, with occasional stirring. Filter and wash the insoluble matter by decantation. After several washings in this manner, transfer the insoluble matter to the filter and wash five times, keeping the mixture well agitated. Treat the filtrate, amounting to about 250 c.c., with 10 to 20 c.c. of saturated bromine water, make slightly acid with hydrochloric acid and boil to expel the liberated bromine.

Make just neutral to methyl orange with sodium-hydroxide or sodium-carbonate solution, then add 1 c.c. of normal hydrochloric acid. Boil again and add slowly from a pipette, with constant stirring, 10 c.c. of a 10 per cent. solution of barium chloride. Continue boiling for 15 minutes and allow to stand for at least two hours, or preferably over night, at a temperature just below boiling. Filter through an ashless filter paper and wash with hot distilled water until a silver-nitrate solution shows no precipitate with a drop of the filtrate. Place the wet filter containing the precipitate of barium sulphate in a weighed platinum, porcelain, silica or alundum crucible, allowing a free access of air, merely folding the paper over the precipitate loosely in a manner that will let in the air but prevent spattering. Smoke the paper off gradually and at no time allow it to burn with flame. After the paper is practically consumed, raise the temperature to approximately 925 deg. C. and heat to constant weight.

The residue of magnesia, etc., after leaching, should be dissolved in hydrochloric acid and tested with great care for sulphur. When an appreciable amount is found this should be determined quantitatively. The amount of sulphur retained is by no means a negligible quantity.

Blanks and Corrections—In all cases a correction must be applied either (1) by running a blank exactly

*Since writing this the author has become Major of Ordnance, United States Army.

[1]Year-Book, American Society of Testing Materials, 1915, p. 605.

as before described, using the same amount of all reagents that were employed in the regular determination, or, more surely (2) by determining a known amount of sulphate added to a solution of the reagents after these have been put through the prescribed series of operations. If this latter procedure is adopted and carried out, say, once a week or whenever a new supply of a reagent must be used, and for a series of solutions covering the range of sulphur content likely to be met with in coals, it is only necessary to add to or subtract from the weight of barium sulphate obtained from a coal, whatever deficiency or excess may have been found in the appropriate "check" in order to obtain a result that is more certain to be correct than if a "blank" correction as determined by the former procedure is applied.

This is due to the fact that the solubility error for barium sulphate, for the amounts of sulphur in ques tion and the conditions of precipitation prescribed is probably the largest one to be considered. Barium sulphate is soluble in acids and even in pure water, and the solubility limit is reached almost immediately on contact with the solvent. Hence, in the event of using reagents of very superior quality or of exercising more than ordinary precautions, there may be no apparent "blank," because the solubility limit of the solution for barium sulphate has not been reached or at any rate not exceeded.

As shown in the preliminary report, the Atkinson and sodium peroxide methods give results in close agreement with the Eschka method. Register has shown that if 15 per cent. of nitrogen is present in the gases contained in the bomb calorimeter the sulphur of a coal is almost completely oxidized to sulphuric acid and the washings of the calorimeter may be used for the determination of sulphur.

The allowable variations are as follows:

	Same Analyst Per Cent.	Different Analysis Per Cent.
Sulphur under 2 per cent	0.05	0.10
Sulphur over 2 per cent	0.10	0.20

I have quoted this method in detail because it has been my experience that the short cuts and modified methods so frequently published generally fail to give satisfactory results in other hands than those of their authors. An experienced chemist, familiar with this sort of work can, in many cases, take advantage of his knowledge to reduce the amount of work this method requires where the highest accuracy is not required. This paper, however, is not intended for the experienced chemist as to him it would be but at best a twice-told tale. To the inexperienced, or to those unfamiliar with this sort of work, however, these short cuts are extremely dangerous, and to them many of the discrepancies in fuel analysis may be attributed.

The combustion of the mixture of coal and Eschka mixture may advantageously be carried out in a gasoline muffle furnace, such for example as the Case muffle furnace manufactured by the Denver Fire Clay Co. The advantage of this type of furnace is that it is self-contained and may be set up anywhere, being independent of gas supply or electricity. By using a furnace with an 8-in. by 12-in. muffle, a number of sulphur determinations may be run at once so that the work is expedited and simplified. I have found it advantageous to remove the capsules from the muffle after they have been heated for about 1½ hours and stir their contents thoroughly with an iron wire and then return them to the furnace. In this way the combustion is hastened and the danger that small particles of carbon at the bottom of the capsule will remain unconsumed is removed.

The coal sample for this determination should be ground until it will all pass a 60-mesh sieve.

In the standard method for the determination of sulphur, mention is made of the possibility of using the washings from the bomb calorimeter for the determination of this element. I have done a good deal of work on this method and as a result I am convinced that it is entirely worthless when applied to high-ash anthracites, as in this case not more than half the sulphur of the coal may be depended upon to be found in the bomb washings. With low-ash anthracite such as the better grades of "prepared sizes" about 75 per cent. of the total sulphur of the coal will be found in the washings from the bomb. It is decidedly unwise, therefore, to depend upon this method and its use should be discouraged.

I have spent much time in developing a volumetric method for determining sulphur in the washings from the Eschka mixture and have succeeded in working out a satisfactory method. In the long run, however, the volumetric was found to be but little more accurate than the gravimetric method, and certainly no more accurate, so it has been abandoned.

A word to the young or inexperienced chemist: Religious adherence to the recommendations of the standard method will secure the accuracy desired, divergence from them will cause errors in the long run.

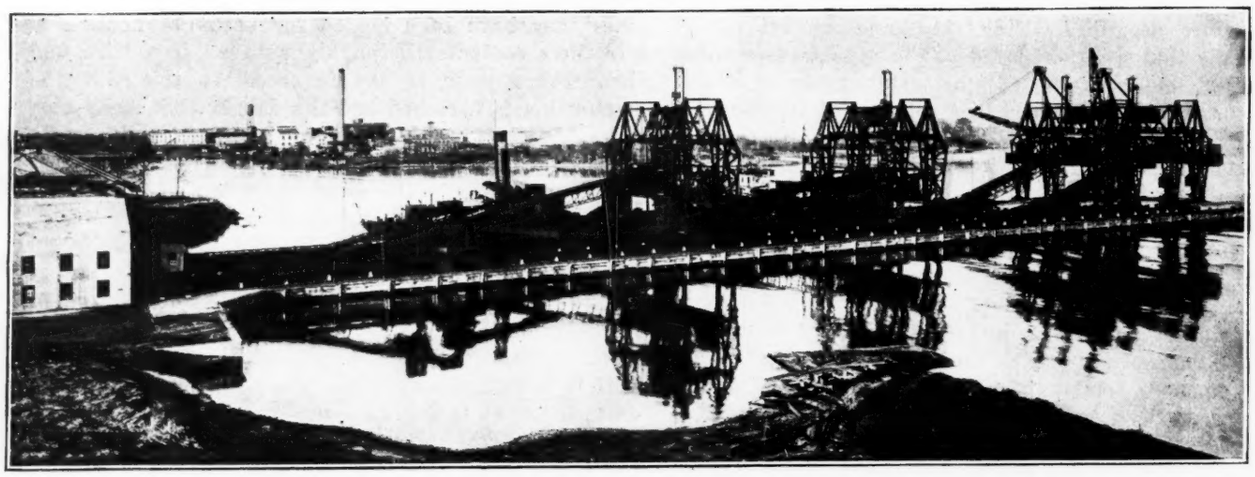
Storage-Battery Locomotive Does the Business

In an anthracite mine at Hazleton, Penn., an Ironton 5½-ton storage-battery locomotive recently replaced a 10-ton trolley locomotive and three mules. This replacement was not due to the trolley machine being incapable of pulling. It arose solely from the fact that here, as in many mines, a 5- or 6-ton locomotive can handle all the loaded cars that are ever ready at any one time. It is not economy to use a locomotive much larger than necessary. The flexibility of the storage battery machine enables it to cover ground as well as pull heavy loads.

It is not unusual to hear some one sing out to the locomotive driver: "Say Bill! Have you got on all the cars she can pull?" The answer will come back, "Yes." "Then put on one more." This is hard on the locomotive, of course, and must be anticipated by husky construction.

The storage battery as built for mine-locomotive service does truly wonderful work if reasonably treated. A workman was recently reproved for putting water in a battery which contained material injurious to it. As it was good drinking water the man thought the complaint unreasonable. "I drinks that water," he growled, "and it don't rust me; and I guess it is good enough for that blankety blank battery!"

With one-half the consideration a mule gets in a mine, the battery will deliver a much stronger "kick." Moreover, the battery delivers the "kick" when it is wanted, and that certainly cannot be said of Maud.



New Methods of Handling Coal Electrically

By C. L. PACKARD
Schenectady, N. Y.

SYNOPSIS — *This article delineates the improvements in coal-handling equipment made by one company in the recent past. Among these are extreme sizes—large and small—of mine locomotives, a new type of locomotive controller and a shipping pier installation for transferring coal from cars to a ship's hold with a minimum of breakage.*

MANY applications of electrical equipment for the coal-mining industry have been contributed by the General Electric Co. during the past year. These cover transportation units and installations of types of standard apparatus in new sizes for hoisting and handling coal at the mine and seaboard and in industrial plants.

Early in the present year there was placed in service at one of the plants of the H. C. Frick Coke Co. a 30-ton, 48-in. gage mine-haulage locomotive equipped with three 125-hp., 500-volt driving motors and a type M multiple unit control, also both straight air and hand brakes. This locomotive is used for main mine haulage and develops 20 per cent. tractive effort (12,000 lb.) at 8.8 miles per hour. It is arranged so that two units can be operated in tandem, thereby bringing the two-unit capacity up to 60 tons.

Among the larger units under construction is one which, when completed, will be the heaviest locomotive of its gage and height so far built. It consists of a 40-ton, 36-in. gage, single unit articulated truck locomotive driven by four 500-volt motors. Its equipment includes automatic air brakes and HC control, which is similar in principle to the well known PC control, except that it is operated manually instead of by compressed air.

While this locomotive is intended for surface hauling, its dimensions are limited by the fact that its route includes a relatively low tunnel. Its overall dimensions are: Width, 6 ft. 1 in.; height over cab, 9 ft. It will develop 20 per cent. tractive effort (16,000 lb.) at 7 miles per hour.

The HC controller referred to was used for the first time on mine locomotives in 1917. As the locomotive units increased in size with corresponding increments in their current demands, it was found that the drum type of controller could not be utilized effectually on account of limited capacity, while the PC type necessitated the equipment of the locomotive with air compressors for their operation.

The HC controller is capable of handling the heaviest currents required by any mine locomotive in service or under construction. The main contactors are actuated by a cam which is in turn moved by means of a simple hand-operated lever. This type of controller was developed to handle 250- and 500-volt mine locomotives ranging from 15 tons rating to 40 tons. The arrangement of this control is shown in Fig. 2.

In contrast to the exceptionally large sizes referred to there was also produced the smallest practical mine locomotive ever constructed. This is a storage-battery unit

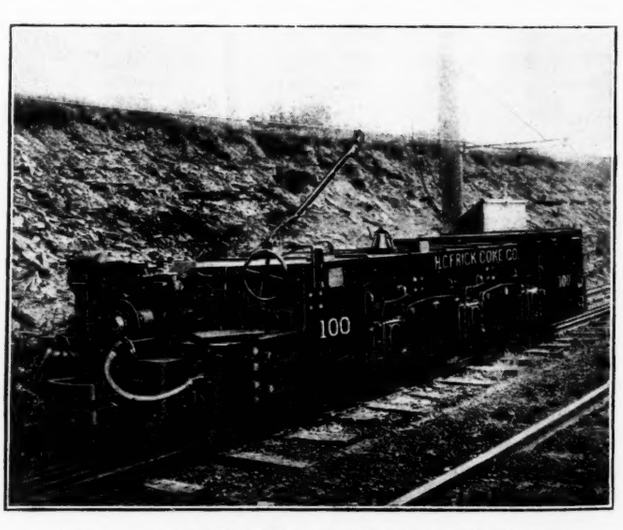


FIG. 1. A 30-TON MINE HAULAGE LOCOMOTIVE

rated at two tons, for operation on 20-in. gage track. It has a single driving motor which gives an effective drawbar pull at 400 lb. at 3 miles per hour. The battery is carried on a trailer having approximately the same dimensions as the locomotive. This machine is shown in Fig. 3.

This outfit was designed for underground service and to meet unusual conditions in mine development work. It is used on different levels in the mine, and its exceptionally limited dimensions—overall length, 48 in.; width, 34 in. and height, 35 in., as well as the fact that the step and operator's seat are removable—permit its ready transfer in the shaft cage from one level to another.

An important development in storage-battery locomotives was the production of a motor specially adapted for this service which rendered feasible the use of a single reduction gear drive. Prior to 1917 the motors applied to this type of locomotive were of the light weight, high-speed type originally designed for motor vehicle propulsion, and double reduction gearing was necessary in order to obtain the low speeds normally required for locomotives. The new motor has the same mechanical characteristics as those used on trolley type locomotives,

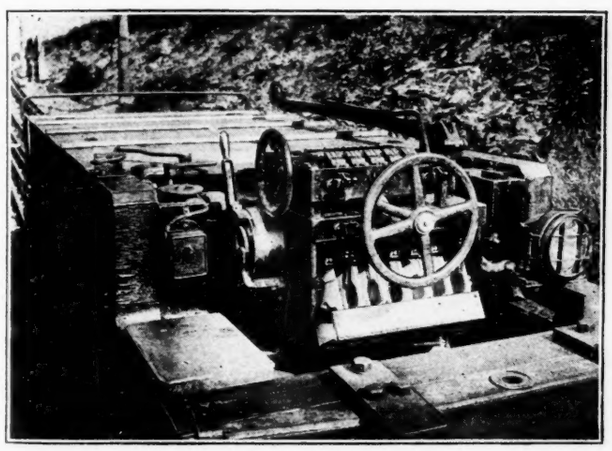


FIG. 2. NEW TYPE OF LOCOMOTIVE CONTROL

and with a slow-speed armature permits the efficient application of the storage-battery energy through single reduction gearing, thereby avoiding the use of the additional gear, pinion and countershaft heretofore required, and eliminating the friction losses they involved, simplifying the mechanical arrangement of the locomotive and reducing first cost and maintenance charges. The saving in energy consumption is, of course, specially important in that it increases the radius of action of storage-battery locomotives for each charge.

While the electrification of mine hoists in 1917 was not equal in number to those of 1916, a large number of installations were made, principally of induction motors. Upward of 90 equipments of 100-hp. and above, aggregating over 22,000 hp., were supplied. A particularly interesting installation was made at one of the Fairmont, W. Va., mines of the Consolidated Coal Company.

This was the initial installation of this type in an Eastern coal field and consisted of duplicate equipments of 1400-hp. capacity, operating on the Ilgner-Ward Leonard system. These equipments are designed to hoist 485 tons of coal per hour from a vertical depth of

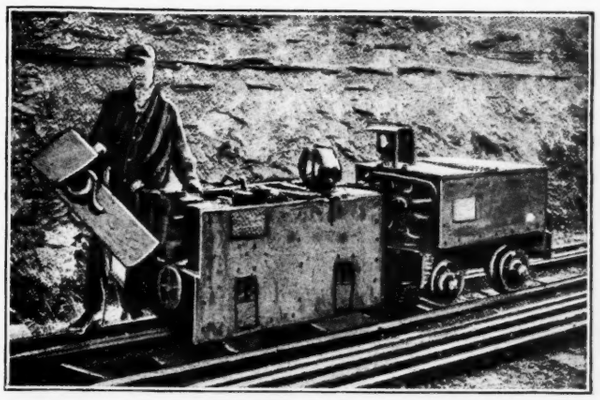


FIG. 3. DIMINUTIVE MINE LOCOMOTIVE

550 ft., 3.25 tons being handled per trip, with the cages operating in balance.

The hoist motor is rated 1400 hp., 90 r.p.m., at 550 volts, its armature being mounted on the same shaft with the winding drum. The drum is of the cylindro-conical type, the cylinder portions being 8 and 11 ft. in diameter. At full speed of the drum the cage speed reaches a maximum of 3100 ft. per minute. The slack rope system is employed in which the lower cage is landed and its empty car replaced by a loaded one during the time the upper car is being dumped. The hoist motor is supplied with power through a flywheel motor-generator set whose demand on the power supply is automatically limited to 600 hp., although the hoist motor develops a peak of 1800 hp. during hoisting.

For coal handling in quantity at an industrial plant equipment was supplied for two high-speed, alternating-current, hammer-head, coal-handling gantry cranes, provided with a unique system of dynamic braking. This was installed at the Steubenville, Ohio, plant of the La Belle Iron Works. Each crane is equipped with a 375-hp. slip-ring induction motor direct-coupled to a 40-hp. direct-current motor, and hoists a 4-ton bucket of coal at 500 ft. per minute.

Dynamic braking is obtained by combining the small direct-current motor with the alternating-current motor so that the direct-current unit serves as an exciter and gives dynamic braking, which is comparable with that ordinarily obtained with direct-current motors on this class of work. This is the first large application

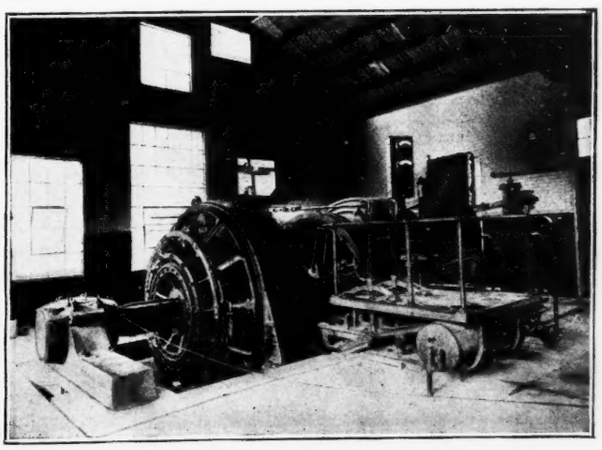


FIG. 4. DIRECT-CONNECTED MINE HOIST

FIG. 5. UNIQUE COAL-HANDLING CRANE

of this system of braking for cranes. It is more economical in first cost and has a number of practical operating advantages when compared with the method which utilizes a motor-generator set in addition to an exciter for securing dynamic braking for alternating-current hoist motors. Creeping speeds of 110 ft. per minute, lowering, are obtainable with cranes under ordinary service conditions.

An interesting application for car unloading and shiphold filling is the installation on one of the Baltimore piers of the Baltimore & Ohio R.R. This pier was designed and equipped for the rapid transfer of coal from cars to shiphold with the lowest possible breakage. Its equipment at the shore end of the pier consists of two steam-operated dumpers, capable of handling forty-five 100-ton cars per hour. In service this equipment has dumped 50-ton cars at the rate of 60 per hour.

The coal at the dumpers is deposited into hoppers and distributed by six short feeder belt conveyors to the conveying belt system of the pier. Two radial incline conveyors pivoted at the car dumpers also deliver directly to the power station hopper or to a balancing bin of 6000 tons capacity. The feeder belts travel at varying speeds and are driven by motors averaging about 15 hp. in capacity. Each incline conveyor utilizes a 150-hp. motor.

On the pier itself, which is 700 ft. in length, there are six longitudinal belts traveling at constant speed. The four inner or main conveyors are about 1000 ft. long, with 60-in. belts, and on either side of the pier is a 48-in., 820-ft. conveyor known as a trimmer. These conveyors all move at the rate of 425 ft. per minute. Each main conveyor is driven by a 300-hp. motor and carries coal at the rate of 1500 tons per hour. The trimmers are driven by 150-hp. motors and have a capacity of 1000 tons per hour each, making the aggregate delivery of the pier 8000 tons per hour. The pier is 110 ft. wide, and the six longitudinal conveyors occupy practically the entire deck space.

The coal is transferred from the four centrally located main conveyors to the hold of the ship by means of four transverse bridges arranged to travel lengthwise of the dock, and carrying shuttle conveyors from which the coal is finally delivered. The operation of the entire system of belts serving each of these bridges is centered in the bridge by means of remote electrical control.

The two trimmer conveyors likewise deliver coal by means of two traveling towers, which move along the sides of the pier, and are provided with 30-ft. projecting booms pivoted at the tower. These can swing 270 deg. horizontally and 90 deg. vertically and deliver the coal from the trimmer conveyors directly into the hold of the ship. The four shuttle belts are driven by 35-hp. motors, and the two trimmer towers and boom conveyors by 40-hp. motors.

In addition to the remote-control system for the widely separated motor drives, a unique arrangement of feeders furnishes current for the various motions of bridges and towers, without resorting to the complicated system of trolley wires or feeder rails with their concomitant contact shoes which would ordinarily be used. This control is accomplished by running all feeder cables in conduits along the deck of the pier and bringing them out through bellmouths located at suitable points, whence they pass over rollers to cable reels mounted on the movable bridges and towers. For the bridges, the necessary tension is maintained on the cable by suitable counterweights when winding and unwinding. In the case of the trimmer towers constant torque motors, similar to those used on mining-locomotive cable reels, are utilized in place of weights. Current supplied at 13,200 volts is stepped down for the operation of three 500-kw. synchronous converters, which in turn deliver current at 550 volts through eight main feeders.

FIG. 6. ONE OF THE TRANSVERSE BRIDGES ON THE LOADING PIERS

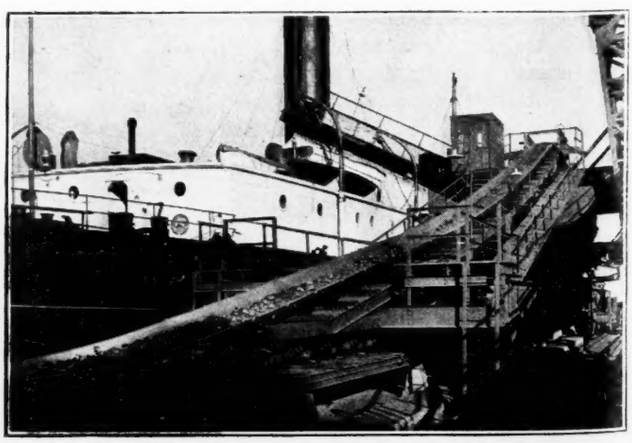


FIG. 7. TRIMMER CONVEYOR AND PROJECTING LOADING BOOM

Coke for Boiler Furnaces

By M. Meredith
Liverpool, England

It is not thoroughly realized by the majority of steam-plant owners that coke and coke breeze can be burned in boiler furnaces with considerable profit and at the same time to the advantage of the nation. The reason doubtless lies in large part in the fact that everyone is too thoroughly occupied with production to be able to spare much thought to changes and minor economies in the boiler house. Yet the difficulty involved is not as great as might be imagined.

S. G. Martlow gave some useful information on this matter recently. In a certain boiler house the partial substitution of coke and coke breeze for Welsh smokeless coal has effected a reduction of 20 per cent. in the fuel bill and saved $3750 in the course of the past year. The Lancashire boilers in which the coke is being burned had been equipped with patent hollow firebars, 17 to each furnace. One firebar was removed from each set and the bars put wider apart, so that the air spaces between bars were ½ in. wide instead of ⅜ in. The passages in the bars as well as in the pigeonholes under the bridge were plugged with refractory clay.

Each ashpit was closed by a casting carrying a pair of trumpet-shaped blower tubes acting as air ducts, and having steam jets controlled by outside stop valves. Except at times of light load forced draft is employed. Because of the situation of the plant smoke was not permissible (this being the reason for the former use of Welsh smokeless coal) and the coke entirely fulfilled this condition.

At the introduction of the byproduct fuel one of the instructions given to the firemen was: "When using coke, never entirely shut the dampers." This was to guard against the possible collection of gas in the flues at standing periods, which might lead to an explosion when the fires were stirred up at any time for a resumption of load.

Compared with raw coal the number of shovelfuls thrown on the grate is considerably more, owing to the difference in specific gravity of the two fuels. Bulk for bulk, the heating value of coke and breeze is less than that of a good coal and the volume of fuel per day put into the furnace is at least 50 per cent. greater; also, cleaning fires has to be done more frequently. Thus the firing is more trying to the men, and there is more clinker than when best Welsh coal (now practically unobtainable) was consumed. Account must naturally be taken of these factors in paying the firemen.

The accumulation of clinker has been diminished to a great extent by enlarging the gunmetal nozzles of the steam jets from the original 1/16 in. to ⅛ in. in diameter. With the larger jets such clinker as is deposited is more easily removed and the life of the gratebars is prolonged.

The saving effected in this case is borne out by the records from other plants. By using a mixture of slack and coke breeze in equal proportions, a saving of 30 per cent. on the fuel bill has been made in the case of a small generating station in the North of England, while considerably greater economies are being effected in plants that have been fitted out with the requisite apparatus for burning a mixture of coke and coke breeze.

Minecdotes

In Which the Mine Boss Emulates King Solomon

The mine boss and the master mechanic were sitting in the office, discussing the extension of a new pipe line, when two miners came in very much excited, disputing the ownership of a certain car of coal which had come up the day previous without a check.

Each presented his case to the mine boss, claiming that he was short one car and the car was his. The mine boss found from the weighmaster that only one car had come up without a check, and as both men had places where they pushed their cars by hand to a parting, he knew he would be unable to identify the particular car in question.

He therefore had no evidence whatever to help find the rightful owner, but in spite of this there was no hesitation whatever in his manner as he turned briskly to the two men.

"Now, I'll tell you what I'll do with you fellows. I don't know which of you owns that car, so the fairest thing I can do is to give each of you credit for half of it. Is that agreeable to you?" turning to one of the miners.

"Yes, that's fair enough," the man replied, after thinking it over a moment.

"And how about you?"

"It don't suit me at all. That car belongs to me, and I want it," the second miner replied.

"Well, you can go. I'll let you know after a while what I will do about it."

After the man had left, the mine boss spoke up to the first miner.

"You've got your nerve to try to put one over me like that. I happen to know that you didn't have your place ready to load coal yesterday until 4 o'clock, and then it was too late to get cars. You heard that we had a car without a check and thought you'd work me for it. I know your kind, and if you ever try to put over any more funny business like that on me I'll fix your clock right. Do you get me?"

The man protested a minute and then walked sheepishly out of the office.

"I'll hand it to you," said the master mechanic after the man had gone. "You handled that pretty slick. The fellow was a rummy, however, to try it when you knew about his having no coal."

"But I didn't know he had no coal. That was pure bluff to make him own up. Any man as willing as he was to split was pretty good evidence that he was getting something for nothing, and I figured if I went at him strong enough he would back down. It's part of the system."

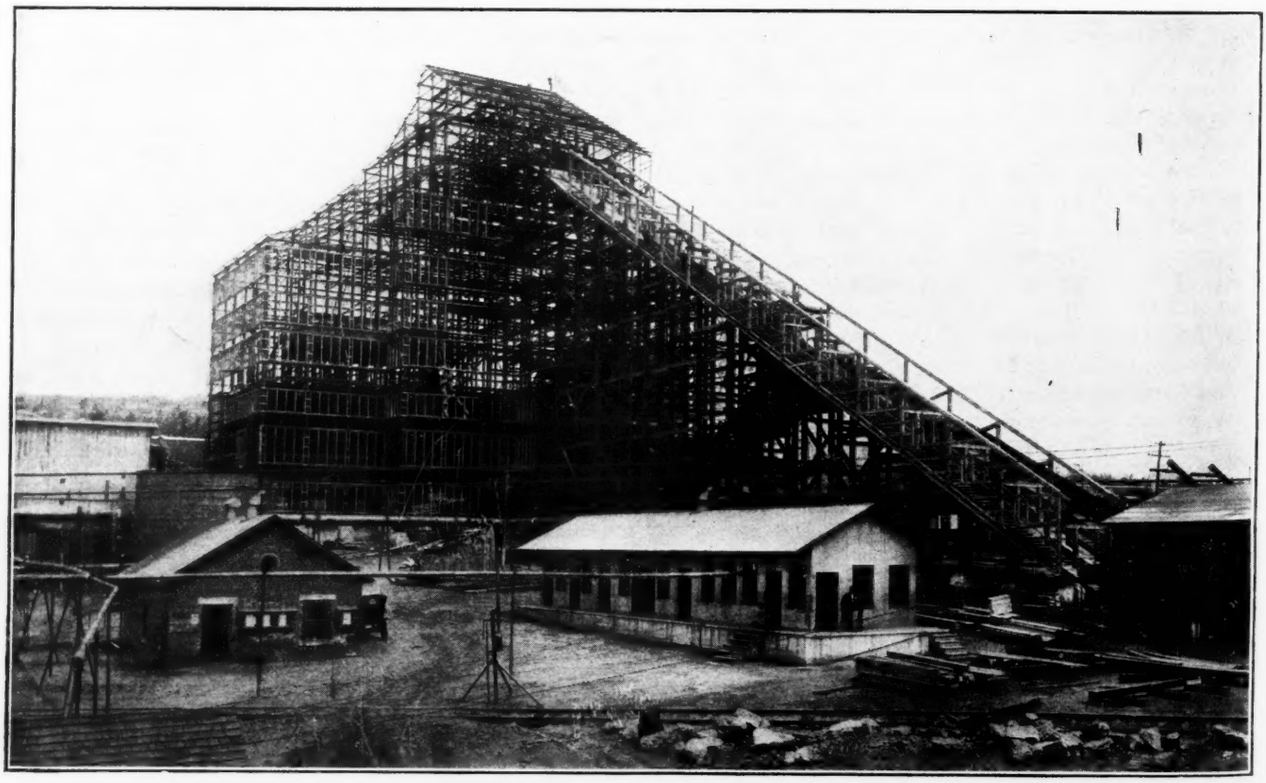
"Well, I'll say one thing for your system; it's sure a good one."

"It ought to be," replied the mine boss. "It's about 3000 years old. Old Solomon was the first man on record to try it, and I guess he was as smart as they come."

[*Coal Age* will pay liberally for short, witty stories for this column. Contributions should breathe the atmosphere of the mine.]

SNAPSHOTS IN COAL MINING

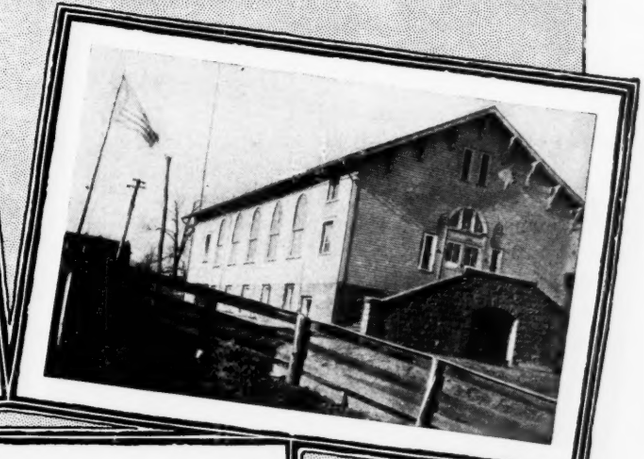
STEEL TIPPLE OF THE CONSOLIDATION COAL CO., NEAR FAIRMONT, W. VA.



MODERN STEEL BREAKER UNDER CONSTRUCTION IN THE ANTHRACITE COAL REGION OF PENNSYLVANIA

SURFACE PLANT
NEW ENGLAND FUEL AND TRANSPORTATION CO.
GRANT TOWN, W. VA.

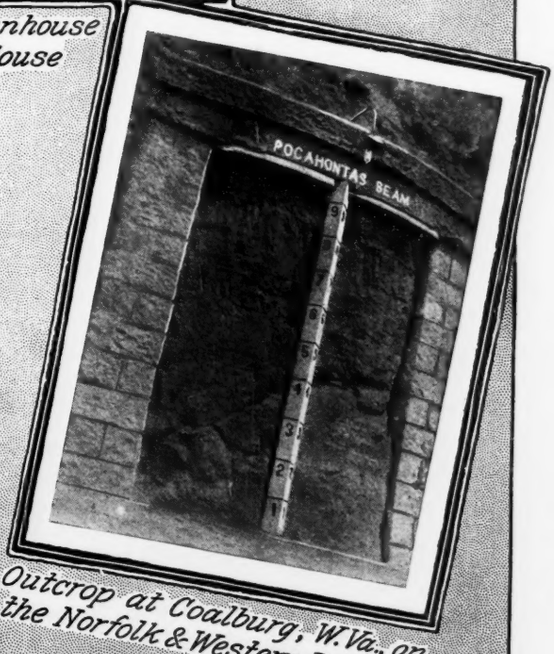
Commissary



Moving Picture Theater and Amusement Hall

Main Shaft, Fanhouse and Boiler House

Shaft and Tipple



Outcrop at Coalburg, W. Va., on the Norfolk & Western Railway

NEW APPARATUS AND EQUIPMENT

Stretcher for Pitching Places

A new stretcher has been developed for coal and metal mines modelled after that used by the Homestake Mining Co. of Lead, S. D. The construction of this stretcher is so strong and rugged that it has been shipped across the continent without any wrapping or crating whatever, yet despite this severe test of its availability for rough work the stretcher arrived in first-class condition at its destination.

STRETCHER FOR STEEP PLACES

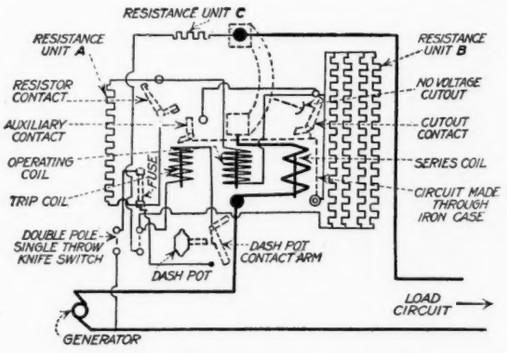
The strong safety feature of this new Homestake mine stretcher is that the patent is securely strapped thereon so that there is no chance of his further injury during transportation. The stretcher may also be raised vertically, up or down an incline, or skidded through the passages without disturbing the patient. For this reason it will undoubtedly prove valuable to many mining companies throughout the country. The Government is now using this stretcher in some departments, and it has been found to give every satisfaction.

The accompanying illustration gives an idea of the ruggedness and practicability of the Homestake mine stretcher for all phases of underground work. It is manufactured by the Mine Safety Appliances Co., Chamber of Commerce Building, Pittsburgh, Pennsylvania.

Automatic Reclosing Circuit Breaker

The Automatic Reclosing Circuit Breaker Co., of Columbus, Ohio, has recently brought out an improved form of automatic reclosing circuit breaker known as type "CN." This breaker is provided with a low voltage lock-out arrangement so that when the breaker is opened either by an overload current or by voltage failure the breaker cannot reclose until the trip coil has operated.

The trip coil can be adjusted so that it will not operate except when the voltage has been restored to 50 per cent. or more of normal value. The accompanying illustration shows the wiring diagram of this breaker. These breakers are designed especially for the protection of motor circuits in mines and industrial plants.

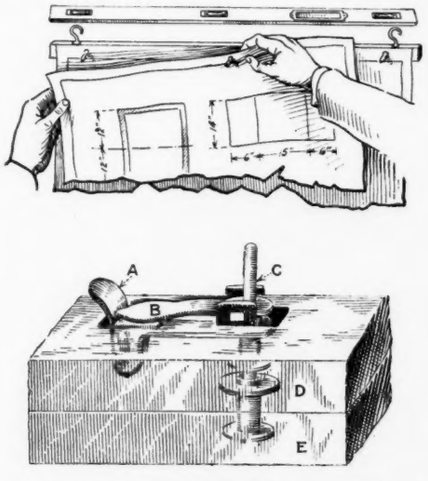


WIRING DIAGRAM OF BREAKER

They are built for 110, 250 and 600 volt direct-current circuits.

Holder for Blueprints and Drawings

A holder for blueprints, records, charts, drawings and newspapers is being marketed by the National Co., 275 Congress St., Boston. Two strips are provided, the upper one being removed when it is desired to add or take out material. These strips are clamped together by means of three catches which permit prints of narrow widths to be held firmly. The holder is suspended by hooks placed at the top. The catch, as shown in detail in the illustration, consists of a hardened-steel stud *C*, fastened to the lower strip *E*, and levers *A* and *B*, the latter being fastened to the upper strip *D*. The device is locked by pressing lever *B* and released by pressing *A*. The holders are made in 30- 36- and 42-in. sizes.



DETAILS OF NEW BLUEPRINT HOLDER

Electric Control Equipment of Mine Hoist

At Mine No. 2 of the Mission Field Mining Co., near Danville, Ill., 2800 tons of coal per day is being hoisted from the valley, where it is mined by stripping. The length of the incline from the valley to the tipple is approximately 1800 ft. This incline is shown in Fig. 1.

The mine hoist is of the traction type, electrically operated. The motor and the control equipment are located in a small house a short distance from the tipple. The motor is operated from 2300-volt alternating-current supply lines and is of 150-hp. capacity.

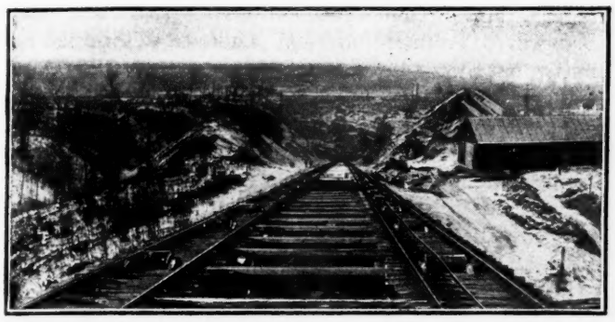


FIG. 1. NO. 2 INCLINE OF MISSION FIELD PLANT

At the top of the incline is a cab, or operator's house, mounted between the tracks from which the hoist runner can watch the loaded cars and shut down the hoist at the proper time by the simple manipulation of a master controller lever. This governs the operation of the magnetic control panel shown in Fig. 3, which is located in the motor house previously referred to.

When the operator at the Mission mine throws the master lever to the "on" or "run" position the series of magnetic switches carried on the control panel close in succession, bringing the motor gradually and safely up to speed by cutting out, step by step, the resistance which is connected in the secondary side of the slip-ring type of alternating-current motor employed. This motor is shown in Fig. 2. The resistance, which is of the grid type, may be seen above the magnetic control panel in Fig. 3. By means of this magnetic control the operator is kept away from the high-voltage current, since his master controller only handles control current which is of low potential. At the bottom of the panel two primary, solenoid-operated, inclosed, oil-immersed switches are mounted. These close and open the main primary circuit to the motor.

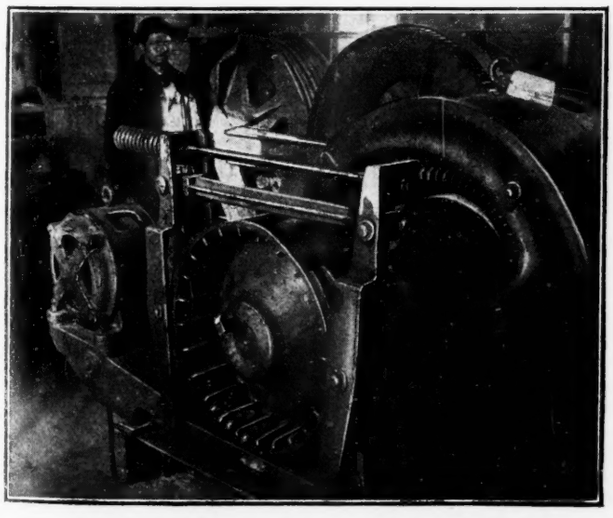


FIG. 2. MOTOR WHICH RUNS THE HOIST

When the operator throws the master lever to the "off" or "stop" position, the magnetic control panel cuts the motor from the line and inserts the resistance in the secondary circuit ready for the next start. A brake of the motor-operated reversible-shoe type is also actuated and brings the motor to a quick stop. This brake appears rather large in comparison to the hoist motor in Fig. 2 because it is in the foreground. The small motor on the end of the brake applies the braking power and replaces the solenoid magnet of the usual direct-current brake. A small pinion on the motor shaft engages with a toothed quadrant which is linked to the arms carrying the brakeshoes. When power is applied this small motor revolves until the brake is released. It then stalls and maintains the brake in the released position until the power is cut off. Adjustment for wear is easily effected by turning a nut on the thrust rod. This brake, as well as the magnetic control apparatus, is manufactured by the Cutler-Hammer Manufacturing Co. of Milwaukee, Wisconsin.

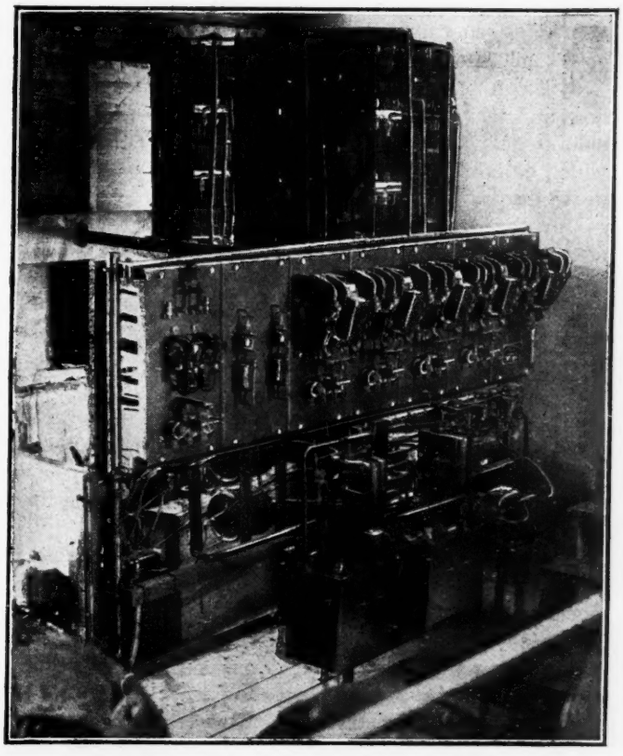


FIG. 3. MAGNETIC CONTROL PANEL

Experience with burning soft coal shows that if soot is once formed a large percentage remains floating in the gases after all other gaseous combustible has been almost completely burned. In a hand-fired furnace analysis of the flue gases will sometimes show no CO when at the same time black smoke is coming out of the stack. Even a large combustion space is not an unfailing solution for burning soot, without a large excess of air.—*Bureau of Mines Bulletin No. 135.*

Nature of Mine Explosions

By H. E. GRAY
Confluence, Penn.

SYNOPSIS—*What the term "explosion" really means, in its application to coal mines. Effect of an explosion in mine workings. The production of air waves, and "trill" of the air previous to the detonation that wrecks all in the path of the fatal blast.*

THE general mining public is sometimes electrified and shocked by newspaper accounts of explosions in mines. No doubt we often wonder how and why such accidents happen. As far as I am able to learn, there is no information yet obtainable which enlightens us fully as to the nature of this great death-dealing factor in mines.

Our textbook definition of the term "explosion" is a "very rapid combustion taking place and accompanied by a violent and destructive expansion of the gaseous products." Such an explanation, however, fails to furnish an adequate idea of the true nature of a mine explosion. The gruesome discoveries, made by rescuing parties after firedamp has done its awful work in a mine, has proved beyond a doubt that the terrible expansive force developed in the narrow confines of the mine is responsible, to a large extent, for the destruction of lives and property in the underground workings.

The mine cars are overturned and demolished, bodies of animals and men mutilated beyond recognition, tracks torn up and other objects lifted bodily and thrown to one side of the passage. Tons of coal and slate are thrown down by the terrible force of the explosion, and obstruct the airways and traveling ways.

My desire is to make clear what constitutes a mine explosion, from the time of its inception, when conditions are practically normal, until it has reached its full development. It should be understood that in considering explosions that occur in underground workings, we have to deal with conditions that differ materially from those that exist in the open atmosphere.

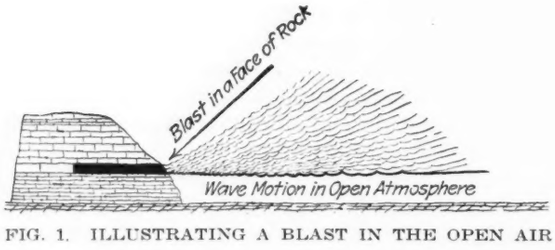


FIG. 1. ILLUSTRATING A BLAST IN THE OPEN AIR

In the case of an explosion of any material on the surface, the air waves produced by the shock or concussion radiate from a common center, in all directions. The greatest velocity of wave motion is at the center of disturbance, or where the explosion originated. Here the waves are shortest and increase in length as they recede from that center till lost in limitless space, as I have attempted to illustrate in the accompanying sketch (Fig. 1), showing the effect of a blast in a hillside.

When an explosion occurs in the open atmosphere, we may observe the following: (1) The explosion develops its maximum force in a moment of time. (2) The vibratory waves produced are not confined within narrow limits, but are free to expand in all directions, into boundless space.

On the contrary, when an explosion occurs in a mine the explosive wave is forced to travel with great velocity through the narrow air passages, and the effect is often increased as it goes by the aid of firedamp and fine coal dust, which is thrown into the air and consumed by the heat and flame of the blast.

In my opinion, a mine explosion develops a vibratory movement of the atmosphere in the mine, resembling the trill of a human voice, and this may be produced either with or without the aid of heat or flame. For instance, I believe that a trill movement may be set up in a mine atmosphere by a rapid subsidence of the roof strata over a large area. The most disastrous explosions, however, are always accompanied by a solid wave of flame.

ROOF LINE
Working Face where the Explosion originates
Advance of Explosive Wave toward Opening
Explosive Trill
NARROW PASSAGEWAY IN MINE

FIG. 2. SHOWING EFFECT IN A NARROW MINE ENTRY

An explosion of gas in a mine may not develop its full force instantaneously, but there is often a gradual development from the place of its inception to the point where it "trills," as I like to express it, or explodes.

The chief elements in the development of a mine explosion are the volume of gas or dust consumed, intensity of heat or flame producing ignition, and the air space or area of the immediate working places.

The movement of the original explosive wave in a mine must always be in a forward direction; and this movement in one direction must be maintained or, as I believe, it will be impossible to develop an explosive trill. The turning back of the flame over the path taken, I think, invariably results in its extinguishment and terminates the explosion. I would say that the distance traveled by an explosive wave, from the point of origin, to the point where it trills or explodes, is usually about 200 feet.

For sake of illustration, let me assume a narrow passageway in a mine, 1000 ft. in length, and that somewhere near the working face is an accumulation of firedamp, sufficient in volume and quality to produce a violent explosion. In some manner this body of firedamp is ignited and produces a large body of flame. The heat of the flame causes a rapid expansion of the surrounding air and gas.

All of this has taken place in a moment of time, and the entire mass of air and burning gas is driven for-

ward, in a single direction by the force of expansion. Because it is confined within narrow limits on all sides, except in the direction of the mine opening, there is formed an advancing explosive wave that moves forward consuming the dust and gas in its path, whereby the temperature and explosive energy are momentarily increased.

The vibratory waves, however, gradually shorten as the propelling forces behind and the retarding forces ahead produce a compressive effect. Every moment increases the velocity of the moving mass of flame and gases, the waves gradually shortening until the climax is reached by a fine vibratory trill movement, and the real detonation of the mass immediately follows. I have again attempted to illustrate my idea, as shown in Fig. 2.

As I have previously stated, men, animals and other heavy objects are picked up as so many feathers in a windstorm and hurled against the roof and sides of the mine. The explosion has now done its work. One thing still remains for us to try to do and that is to show how explosions in mines may be prevented.

Upkeep of Adequate Motive Power

In speaking before the United States Chamber of Commerce in its sixth annual meeting in Chicago recently, Alba B. Johnson, president of the Baldwin Locomotive Works, took the ground that Congress should place upon the functionary charged with the making of railroad rates the responsibility of making the rates sufficiently high for thorough maintenance of the roads.

Tracing briefly the development of the locomotive from the days when they weighed five tons each to the present type, weighing more than 500,000 lb., Mr. Johnson showed how the spur of competition had been responsible for America's progress in handling its vast transportation problem up to its present high point of efficiency, where "American railroad men need have no fear of comparison with other countries either in the encouragement given to improvements in engineering practice or in the reductions which have been achieved in the cost of transportation." Continuing, Mr. Johnson said:

> The participation of the United States in the world-war has brought about new conditions. A mass of legislation and regulation which had accumulated during years of peace and which was predicated upon certain popular fears and prejudices resulted in the failure to allow increase in revenues corresponding to increased costs. The necessities of the war soon demonstrated that these regulations which prevented coöperation by insisting upon competition, did not make for efficiency, but prevented many measures of improved service which the railroad managers were themselves eager to adopt but which had been made prohibitive. In order at a single stroke to untangle this situation, the Government decided that it was wise to assume control of transportation by placing all the principal lines in the control of a director general of railways, and to operate the roads as a unit during the period of the war and for a fixed time thereafter. For the first time in the history of the country all of the railroads became subject to a unity of management and to a unity of control in their purchases. For the first time it became practicable to adopt and to enforce standards to a large extent.

The whole problem of standardization Mr. Johnson discussed at length, pointing out the obvious operating advantages on the one hand and contrasting with them the possibilities of the paralysis of invention and the stagnation of new improvement on the other. "It would be an evil day," he said, "for American engineering, for American progress in the art of transportation, which would involve a policy of discouragement to new and useful improvements in the art. We should therefore look carefully before we leap, to make sure that we are not giving up the substance of continued growth in efficiency and economy, to grasp the chimera of standardization. Especially should this be considered most carefully when the world-wide danger of this war is upon us."

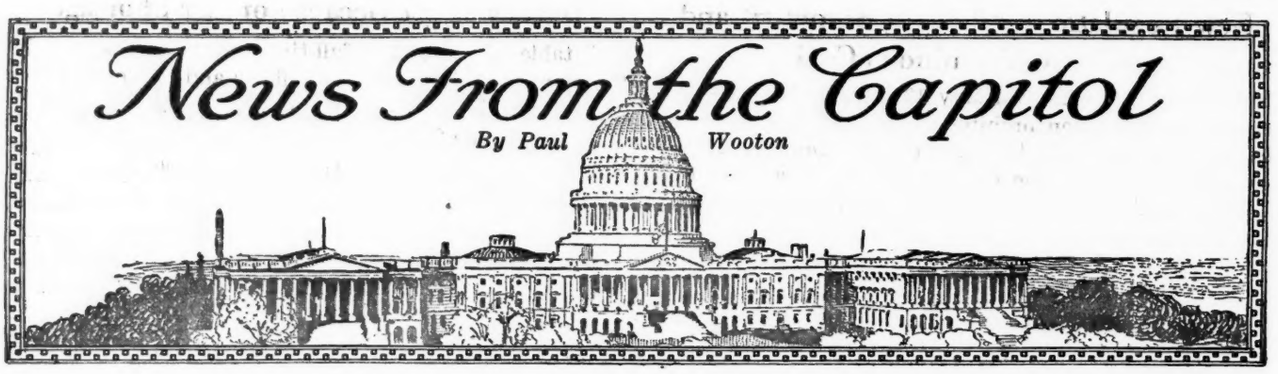
Turning to the remarkable growth and development of electric power in transportation, he briefly reviewed its history from the electric locomotive ordered by the Northern Pacific in the early '90's up to the present when electrical engines are part of the standard equipment of such lines as the New York Central, the New York, New Haven & Hartford, the Pennsylvania, the Chicago, Milwaukee & St. Paul, the Norfolk & Western, and others. As to the future relationship between steam and electricity, Mr. Johnson said:

> Doubtless the electrification of suburban lines and the application of electricity to lines having great density of traffic will be financially justified, and as these grow in number and join themselves together electric zones will be created in which it will be economical to adopt electricity exclusively as the motive power. Any question of rivalry between the steam and electric locomotive may be set aside. The problem is wholly an economic one, the only question being as to which is the more efficient and suitable for the particular conditions, and the consequent adoption of one or the other is dependent upon the geographical or other circumstances governing each case.

Speaking of the admittedly inadequate motive power of our present equipment, Mr. Johnson said:

> During the depression preceding the war there was a small surplus of power which, as should have been foreseen, was absorbed in traffic with the first increase of activity. As a rule, railroads have purchased locomotives largely under the spur of excessive traffic and have abstained from purchasing during periods of reduced earnings. This is contrary to the economics of the situation. Enlargements of facilities should be made in times of depression. The reason the railroads have not done this since 1907 is that under the regulatory policy which went into effect at the time, railway managers have not been able to accumulate surpluses sufficient in their judgment to warrant bold construction in times of small earnings, and especially because future earnings have not been susceptible of approximate calculation even where the volume of traffic could be estimated in advance. Adequate provision of motive power, like adequate provision of other rolling-stock and other facilities, can only be assured when Congress places upon the functionary charged with the duty of regulating rates, the definite responsibility of making such rates as will yield earnings sufficient for thorough maintenance, for adequate improvements and sufficient to attract the capital necessary for providing additions and extensions.

The low percentage of combustible in the furnace gases when the excess of air is large is not entirely a result of improved combustion, but to some extent is due to the dilution of the gases with air. It is evident that with a large excess of air, the percentage of combustible gases is less, even if there be no improvement in the combustion. Therefore, when the air supply is varied the percentage of combustible gases does not reliably indicate the completeness of combustion.—*Bureau of Mines Bulletin No. 135.*



Weekly Production Statistics

A break occurred during the week ended May 4 in the steady increase in production of bituminous coal which had taken place for three successive weeks. The decrease over the record production of the week ended Apr. 27 was 2 per cent. Telegraphic advices to the Fuel Administration show that the production for the week ended May 11 practically equals that of the week ended May 4. During the week ended May 4 production totaled 11,559,000 net tons.

Anthracite forwardings were 40,570 cars, thus showing a substantial increase over the week ended Apr. 27 and preserving unbroken the recurring increase since the first of April.

Beehive coke production fell off to 657,000 tons during the week ended May 4. The decrease was a full 11 per cent. Shortage of labor is given as the principal cause. Byproduct coke production showed a gain over the week of Apr. 27 and now stands at practically 90 per cent. of the full-time capacity of the ovens.

The estimates given above are those of C. E. Lesher, the geologist in charge of coal statistics for the United States Geological Survey.

Fuel Administration Asks Appropriation

Congress has been asked to devote $4,575,000 for the maintenance of the Fuel Administration from July 1, 1918, to June 30, 1919. The appropriation is to be supplied as follows:

Salaries	$2,392,000
Temporary employment	381,000
Traveling expenses	750,000
Services other than personal	565,000
Supplies and equipment	368,000
Purchase, operation and maintenance of passenger-carrying motor-driven vehicles for use of United States Fuel Administrator, his assistants and deputies, in the business of the Fuel Administration	10,000
Law books, periodicals, and books of reference	5,000
Rent	104,000
	$4,575,000

Drive for Coal Orders To Be Made During "Coal Week"

The marked success which has attended the setting apart of a week for Liberty Loan and Red Cross drives has led the Fuel Administration to designate the week beginning June 3 as "Coal Week." During that week systematic efforts will be made throughout the country to secure the booking of coal orders. Dealers are to be asked to give publicity to the fact that purchases of domestic fuel will be delivered in the order of their receipt.

To Supervise Distribution of Lake and Canadian Coal

In order that special attention may be given the distribution of Lake and Canadian coal, C. P. White has been placed in immediate charge of these activities of the Fuel Administration. For 20 years Mr. White was in charge of Lake Superior coal dock properties. This experience brought him in close touch with the fuel needs of Canada and the Northwest. He also has been connected with the coal department of the Wheeling & Lake Erie R. R. and formerly was in charge of the Pittsburgh Coal Co.'s operations north and west of Chicago. For a time he was vice president of the Carnegie Dock and Fuel Co. with headquarters at Minneapolis. Until recently Mr. White has been general manager of the Clarkson Coal Mining Co., which conducts operations in eastern Ohio.

Railroad Fuel Question Still Unsettled

Illness of Director General McAdoo made impossible last week further steps looking to the settlement of the railroad fuel controversy. Reports to the Fuel Administration show that the railroads are buying on a hand-to-mouth basis and are not entering into contracts. Loss of production is resulting from the fact that operators cannot enter into contracts with others, as they know that the railroads must be supplied with fuel.

To Conserve Power Plant Fuel

Fuel conservation in power plants is to be insisted upon by the Fuel Administration. Active steps in this direction are being taken. Thomas R. Brown, of Pittsburgh, Penn., has been appointed administrative engineer for the Pittsburgh district, with C. P. Dilling as his assistant. Other administrative engineers will be appointed for other districts.

The Fuel Administrator hopes to save 50,000,000 tons of coal during the next year in industrial plants. This is to be done largely by correcting firing and operating methods. Each power plant is to be inspected personally. Each plant will be rated on the basis of the thoroughness with which the conservation regulations are carried out.

While no mention is made by the Fuel Administration that plants with the lowest ratings will be the first to be cut off from fuel supply, when there is not enough coal to go around, it is believed that that practice will be pursued.

New Regulations Affecting Shipment and Sale of Bituminous Coal

A regulation issued on May 13 by the United States Fuel Administration prohibits the shipment by way of the Great Lakes and the sale, distribution and use of smokeless coal from the Pocahontas and New River districts in Virginia and West Virginia, for domestic purposes in Wisconsin, Minnesota, North Dakota, South Dakota and Iowa.

By an additional regulation bituminous coal from the states of Pennsylvania, Ohio, Maryland, West Virginia, Virginia, Eastern Kentucky and Tennessee, is barred from shipment by way of the Great Lakes into the State of Illinois for sale, distribution, or use for domestic purposes.

Lake forwarders, dock owners, wholesale and retail dealers, and others are warned of severe penalties for violation of the orders in disposing of coal from the Lake ports for domestic uses where the coal has come from the prohibited districts to the Lakes for blacksmithing and byproduct uses as permitted by the zoning orders put into effect by the Fuel Administration and Railroad Administration on April 1.

Under the zone plan coal from these districts when shipped to the Lakes must be used for certain specified purposes and those coals named are among those prohibited under the zone plan for domestic use. The new regulations are designed to prevent the coal, after reaching the Great Lakes, from being transferred and distributed for domestic purposes. Both regulations are made effective at 7 a.m., May 27.

A third regulation issued today by the Fuel Administration widens the zone in which coal from the Lake Superior docks may be sold and distributed so as to include all points in the State of Montana, located along the line of the Minneapolis, St. Paul & Sault Ste. Marie Ry. between Westby, Mont., and Whitetail, Mont. This order is effective May 20.

To Curtail Use of Fuel Oil

No significance should be attached to the fact that the Fuel Administration has in mind the curtailment of the use of fuel oil in the States of Oregon and Washington, according to Mark L. Requa, the head of the petroleum division. Local conditions in those states, Mr. Requa says, probably will require such action. He explained, however, that it does not hold that fuel oil is to be denied consumers in other sections where coal is available.

Maximum Prices Fixed on Beehive Coke

Beehive coke made in Wise and Lee Counties of Virginia must not be sold for more than $7.25 a ton f.o.b. cars at the ovens. The price of 72-hour selected foundry coke is fixed at $8.25.

At the Howe plant in Oklahoma the price fixed for blast-furnace or smelting coke is $10.75, and for 72-hour selected foundry, $11.75.

Screened and sized crushed beehive coke made anywhere in Colorado is subject to a maximum price of $9.80, according to an order issued last week by the Fuel Administration.

Tonnage Lost Because of Car Shortage

A table, showing the full-time capacity of mines in the more important producing fields and the loss during the week ended Apr. 20, due to car shortage, has been compiled by the Geological Survey. It follows:

Producing Field	Full-Time Output Tons	Production Lost Because of Car Shortage—Tons
Illinois	2,370,000	322,000
Indiana	640,000	112,000
Southern Ohio	460,000	243,000
Northern and central Ohio	930,000	293,000
Western Pennsylvania	2,075,000	263,000
Central Pennsylvania	1,882,000	147,000
Somerset County, Pennsylvania	153,000	70,500
New River and Winding Gulf	413,000	114,000
High-volatile fields of Southwest Virginia	825,000	265,000
Fairmont, W. Va	230,000	102,000
Cumberland and Piedmont	214,000	17,000
Northeast Kentucky	230,000	37,000
Western Kentucky	320,000	33,000
Southern Appalachian	428,000	20,000
	11,170,000	2,038,500

No Coke To Be Shipped to New England

New England must rely on itself for coke. An order has been issued by the Fuel Administration forbidding the shipment of coke, made in New England, outside of those states except to Albany, Cohoes, Green Island and Troy, New York. Shipments of coke into New England from other states are also prohibited.

Plan To Reorganize National Coal Association

A plan for the reorganization of the National Coal Association is to be presented at the annual meeting to be held in Philadelphia, May 28 and 29. The form of organization will be changed from a temporary one to a corporation. It is proposed to incorporate it under the laws of the State of Delaware. There are to be 37 directors, as follows:

Washington, Iowa, Indiana, Alabama, Michigan, Virginia and Maryland, one director each. Montana and Northern Wyoming, one director. Utah and Southern Wyoming, one director. Colorado and New Mexico, one director. Arkansas, Oklahoma and Texas, one director. Kansas and Missouri, one director. Tennessee and Georgia, one director. Western Kentucky, one director. Eastern Kentucky, one director. Ohio, two directors. Pennsylvania anthracite, two directors. Illinois, three directors. West Virginia, three directors. Pennsylvania bituminous, four directors. Eight directors at large also are proposed. An initiation fee of one-fourth of one mill on each ton of annual production will be charged.

Brief Washington Notes

Zone B regulations have been changed so that shippers may forward smithing coal into the area west of the western boundary of North and South Dakota, but not south of the southern boundary of Zone B.

No anthracite will be allowed to move west of the Mississippi or into the South, it is understood. It has been deemed necessary to restrict the consumption of anthracite to those sections of the country where it is most greatly needed and which are not too distant from the points of production.

THE LABOR SITUATION

EDITED BY R. DAWSON HALL

General Labor Review

The strike of the coal miners in the Huntingdon and Broad Top region of the bituminous coal field of Pennsylvania was not unexpected. The wage provided Dec. 4 of last year was arranged to end Apr. 1 of this present year. The operators apparently thought that December was not a seasonable time for resisting a strike and preferred to shelve their difficulties rather than to face them.

In effect they seem to have believed that Apr. 1 would find such a slackness of market as would make them and the public generally indifferent whether the mines worked or were idle. Some may have thought the war might by that time be at an end.

Early last winter there were in the country plenty of optimistic people who believed that the war game would never be played to a finish, that the players would lay their cards on the table, the Kaiser then conceding that it was useless to hope to win as against the full hand of Uncle Sam. We now know that the Kaiser was figuring on the man-power of Russia; we have recently seen two big salients driven into the British line, and we are now more ready than ever to admit that several Mitchell days may go by before the war comes to an end.

As the war excitement became greater rather than less, Apr. 1 found the demand for coal almost as great as on Dec. 4. Consequently the miners' strategic position is in many ways as good or better than in the year past; for the demand for coal is still severe, and now the miners can claim that the scale they are asked to accept is a reduction from the former scale. Had the higher scale never been granted that could not have been said.

The rate of mining per ton during the winter was $1.11. It is now $1.01. The yardage rate is also cut 8 per cent. As stated, the change in rate took place Apr. 1, but the mine workers did not strike immediately. They accepted one pay at the lower rate and finally quit on May 8.

CARS WILL GO TO IDLE MEN IN OTHER FIELDS

The laying idle of this small area need not reduce the output of bituminous coal. The cars it would normally receive can be shifted to other sections of the country where the men have been satisfied to fare as well as, and no better, than their fellows. The output of the region is not large, only 8500 tons a day. As some big single mines produce an equally large amount of coal it would be a small matter were the whole tonnage of the Huntingdon and Broad Top region lost to the country, but, as stated, this 0.45 per cent. of the whole national tonnage can be readily supplied elsewhere by miners who would otherwise be kept idle for lack of cars.

The fact that the Huntingdon and Broad Top miners get a larger wage than the rest of the miners in central Pennsylvania was the reason for the recent dissatisfaction in that large and important region. To give the miners in the Broad Top region what they ask is likely to make trouble in the larger area. To deny it to them is likely to result in greater satisfaction. Everything seems to show that the improvement in the strategic position of the Broad Top miners is offset by the knowledge that what they ask can only be conceded by raising up difficulties which cannot be dismissed with indifference.

On May 9 the only mine in the region still working was that at Jacobs. A meeting, called by Fuel Administrator Garfield, was to be held May 17 at Washington, D. C., but at the time of going to press the delegates to that meeting were not yet in session.

Another development of interest is the determination of the Consolidation Coal Co. to enter into contract relations with its men. The company has always been a model employer, but it has resolutely combated the unionization of its workmen, feeling that a union meant an organizing of discontent. Operators have feared that discontent became chronic wherever an institution was formed with the apparent purpose of keeping such discontent alive. Some men who read patent-medicine advertisements are ready to crawl into the grave, imagining they have all the ills described, and similarly some well-satisfied men who join a union begin to sense all manner of social ills as soon as they are suggested to them. A fear of something akin to hypochondriacism makes operators afraid of the spread of union activity.

On May 9, George T. Watson, president of the Consolidation Coal Co., at a meeting of the leading operators of the Fairmount region said as follows: "The war has changed everything. The get-together spirit is in the air. Labor and active capital are working together in a common cause —winning the war—and real democracy is sure eventually to triumph.

CONSOLIDATION COAL COMPANY GRANTS OPEN SHOP

"The Consolidation Coal Co. heads have, for some time, been engaged in formulating a plan of getting-together with their men. Consequently, the present action is not exactly sudden, though the determination to put it into effect came very suddenly, without giving the opportunity for such a general consultation as we would have preferred.

"The coal industry has never had a clear sky until now. It has been handicapped by conditions which are being remedied by the coöperation of employer and employed with the United States Fuel Administration."

The Consolidation Coal Co. is proposing to have mine committees at all its mines and plans to welcome the appointment of an umpire by the judge of the United States District Court, whose appointment will be subject to the approval of the United States Fuel Administration and who will be payable by the company and the employees conjointly.

On May 6 the aides of the United States Fuel Administrator, Rembrandt Peale and John P. White, proposed a solution for the Maryland trouble which solution follows closely along the lines of the Alabama settlement, namely: (1) Mine committee of three at each mine. (2) Secret balloting for that committee. (3) No grievances to be discussed during working hours by mine committees. (4) Reference of debated matters to manager and, if not settled in three days, further reference to an umpire. (5) Matters must be submitted to umpire within 30 days or right of appeal will be denied, unless an extension of time has been agreed upon. (6) All agreements shall be in writing, shall be final and not subject to appeal. (7) Umpire shall be appointed by Judge Rose of the United States District Court of Maryland and be subject to the approval of the United States Fuel Administration. (8) Should two nominees be found unsatisfactory, the administration itself is empowered to name the umpire. (9) The umpire shall be paid by operators and mine employees jointly each contributing one half of salary. (10) Mine committee members to be protected against discrimination except when using intimidation or coercion. (11) Right of reëmployment conceded to employees discharged for affiliation with the union. (12) Right to have a check weighman on each tipple where coal is weighed. (13) Checkweighman shall not be elected more often than once in three months unless a vacancy exists. (14) Checkweighman shall be paid by a check-off taken from the wages of hand and machine miners and loaders. (15) The turn shall be even. (16) Pay day shall be semi-monthly. (17) The penalty for

interrupting the operation of a mine or causing a strike is $1 per day for each day or fraction of a day the mine worker lies idle. (18) The penalty for a lockout is a dollar per day for each mine worker affected. (19) All fines are payable to the American Red Cross through the umpire. (20) The agreement shall continue in force at least two years or for the duration of the war, whichever is the longer period of time. Thereafter it shall be subject to revision upon 90 days' notice by either of the parties.

The action of the Consolidation Coal Co. and the anticipated action of the United States Steel Corporation seems to make the "open shop" in the mines of the United States almost an accomplished fact. A few ununionized sections will still remain in southern West Virginia and some in western Kentucky. Everywhere else the open shop will have full sway. Much water has passed over the wheel since the United States entered the world conflict.

The union and operators alike prefer to do business through the Fuel Administration and do not like to submit their differences to the so-called Labor Dictator, who bears the euphonious name of Felix Frankfurter. Mining men believe that they understand their own wants best. A meeting was held Thursday, May 16, to discuss the situation, Fuel Adminstrator Garfield, Advisers Peale and White, President Hayes, Vice President Lewis and Secretary Green being present.

The gradual unionization has done much to heal the differences between operators. The union and nonunion operators have always looked at one another somewhat askance. Propaganda suited to one field did not suit the other. Institutes found their members more or less at cross purposes. Coal associations spread with difficulty over the line which divided union from nonunion regions. Several companies were opposed to any entry into organizations doing business with the union. In fact they could not well associate themselves effectively with them.

The new labor conditions have had no little to do with the formation of the Central Pennsylvania Coal Producers Association with a membership representing mines producing 30,000,000 tons per annum. This has taken the place of the Coal Operators Association of Central Pennsylvania which represented about 8,000,000 tons of annual coal production and the Low Volatile Association, a newer body representing 20,000,000 tons.

Charles O'Neill, who has been vice president of the central Pennsylvania United Mine Workers, has been selected as general secretary of the Central Pennsylvania Coal Producers Association. O'Neill is a young man, but he has been quite influential in the union. He was for a number of years private secretary to Patrick Gilday, the president of District No. 2. When James Purcell succeeded Patrick Gilday, O'Neill became vice president of that district. For some months O'Neill has been in Washington taking the place of ex-president J. P. White, whenever the chief was touring the country for the Fuel Administration.

Reports about Liberty Bonds still come in and some will have to be deferred to the coming issue. In some instances there seems to have been some well-meant, but unfortunate, violence used by the bond sellers. It is just as well to avoid physical compulsion in the selling of bonds. If anyone thinks more should be subscribed let him buy more himself. If the Government had intended a forced levy; it would have provided for it by law. There are some arguments for the Government taking such a course; to many Australians, especially, this has seemed the best plan to adopt. However, till we make such a law there is no compulsion, and we certainly under no circumstances do well to haze or mistreat those who do not buy.

A more generous subscription would be a better way of meeting the issue, for the purchase of a big bond is a financial bargain for the investor. If he buys twice or three times as large a bond by that much is he the more benefited. When the verdict of the people is for compulsion, then let us have compulsion. At all times let us use alone methods that are lawful.

At a special convention held May 3 the Alabama mine workers ratified the new wage scale, details of which appear in our issue of Apr. 27, and on May 12 the Maryland mine workers approved of the working conditions already outlined in this review.

A 100 Per Cent. Liberty Loan Subscription

The Lehigh Valley Coal Co. has 17,496 employees. Out of this large number not one failed to subscribe in some amount to the third Liberty Loan. The average subscription was $57.01.

The employees of the company purchased $313,550 worth of the first Liberty Loan and $446,500 of the second, while the subscriptions to the third loan booked by the company for its employees lacked only $2500 of reaching one million. In other words $997,500 in third Liberty Loan bonds were sold by this company to its employees.

The men themselves took great interest in the loan and did much both individually and collectively to swell the number of bond buyers. Sometimes the arguments presented to the men who were reluctant in their purchases took forms bordering on the disorderly. "Slackers" were painted or placarded, and paraded through the villages where they resided.

In obstinate cases the mines were made so unpleasant for them that they either subscribed for a bond or quit work. So far as is known no actual violence or permanent injury was done either to person or property. In one instance the "patriots" conducted a miner to the brink of a reservoir and induced him to purchase a bond by threatening to "baptize him by immersion." Confronted with the certainty of a thorough ducking he finally consented to buy a bond. But after exacting this promise somebody suggested that he be given a ducking "just for luck," and he accordingly got his ducking, much to the delight of the crowd.

Throughout the campaign the coöperation between the local unions and the company officials has been close and cordial. Local union No. 458, at Maltby colliery, had $2000 which it decided to put into Liberty Bonds. The local banks got wind of the fact and several put in an application that the purchase be made through their institutions, but the union men wanted the subscription to be given through the company. Local union No. 1546, of Franklin colliery, with its investable fund somewhat depleted by a subscription of $1200 to the previous loan put $300 in the third issue, and gave the company credit for gaining the subscription. Local No. 1732 of Warrior Run colliery similarly invested $1000 in bonds.

Southern Anthracite Locals Also Buy Bonds

When the locals of the Lehigh-Coxe, the Delano and the Mahanoy & Shamokin divisions heard that the locals of the Lackawanna and Wyoming divisions were placing their subscriptions through the company they decided to do the same. In consequence Local No. 2848, of Sayre colliery, bought $500 worth through the company. Local No. 82, of Spring Brook colliery, took $100 worth, Local No. 961, of Spring Mountain colliery, $500 worth; Local No. 185, of Tomhicken colliery, $100 worth; Local No. 1381, of Lattimer strippings, $200 worth; Local No. 2631, of Oneida colliery, $100 worth and Local No. 2838, of Vulcan colliery, $250 worth, all through the Lehigh Valley Coal Company.

The company showed its appreciation ungrudgingly and in a little booklet it gives in greater detail the list we have just quoted in brief. The gracious act of the unions has strengthened the strong accord which is growing up between them and the company, and the good will is heightened by the Lehigh's recognition of the broad-minded attitude of its employees.

The company's record somewhat remodeled is as follows:

Division	1st Loan Amount	2d Loan Amount	3rd Loan Amount	3rd Loan Per Person
Treasurer and Controller's Dept., New York	$3,750	$3,100	$5,550	$132.14
Snow Shoe	8,850	12,400	22,000	60.27
Drifton Shops	10,050	6,350	15,900	58.45
Lackawanna Division	39,400	95,300	191,900	55.93
Mahanoy & Shamokin Division	75,300	42,800	175,200	55.58
Wyoming Division	56,600	118,700	211,650	55.30
Wyoming Valley Water Supply Co.	950	200	3,150	55.26
Delano Division	34,850	28,850	106,550	55.20
Lehigh-Coxe Division	45,700	104,800	225,600	53.49

It will be seen that the one bituminous mine of the corporation led all the anthracite mines of the company in the generous size of its subscription.

EDITORIALS

Making Coke May Yet Be "Verboten"

NEW developments make new duties. In the coke industry manufacturing coke in "clamps" was the first development, and therefore the first offense against conservation. Only in China is that wasteful process still in operation. The beehive oven then followed as the ideal means of coke making, because it made better coke with less waste of fuel. Then came the Belgian oven, which saved labor, and the flue system, which supplied heat to boilers. Then, as what seemed a final economy, came the byproduct oven, or rather the series of byproduct ovens. To build anything else is now a crime punishable by unsuccessful operation and financial loss.

The article which we publish on page 912, "Bettering Coal by Heat and Pressure," awakens grave question as to whether we have any right to make coke at all. We are led to question whether instead of merely aiming badly we have been actually shooting at the wrong target altogether. This is almost certain if the experiments of Charles H. Smith are as revolutionary as they appear from the figures given in the article. However, it must be remembered that some mixtures of coal when coked in byproduct coke ovens give twice as much oil and tar as others and that the metallurgical value of carbocoal can only be determined by careful tests.

The following table is taken from Table II of Mr. Malcolmson's paper, but some of the information is consolidated and we think it reveals in consequence the value of the low-distillation process in a more striking manner. The last column shows the relative proportions of substances obtained by low-temperature distillation and by coking, the difference being most marked in the light oils. With carbocoal, according to the table, seven times as much oil is obtained as with byproduct coke.

RECOVERY OF LIQUID PRODUCTS PER SHORT TON OF RAW COAL PRODUCT

Product	Byproduct Coke Oven	Carbocoal	Relative Product
Light oil	0.27	1.583	5.863
Middle oil	0.44	3.326	7.559
Creosote oil	0.78	3.236	4.149
Heavy oil	1.26	11.365	9.020
Total oils	2.75	19.510	7.095
Pitch	4.66	10.190	2.187
Total products	7.41	29.700	4.008

The amount of carbocoal obtained is also quite high, and the ammonium sulphate produced 21 lb. per short ton of raw coal carbonized. Whether coke is to be a forbidden product or not is, of course, a question; but it looks as if a formidable rival had arisen. Our treatment of coal has always been ruthless. A body with such complex characteristics should have been handled with more circumspection.

In England low-temperature distillation of coal has made much progress, and it seems fully probable that the saving of byproducts will pay many times for the work involved, even should it be found that the improvement in the fuel was not enough in itself to pay the expenses of manufacture.

For the Worker, Work Is Patriotism

THERE is a complaint that some mine workers are of such a patriotic kidney that they take every opportunity to celebrate. It is hard to keep them at their work. A little celebration now and then does no one any harm. It puts vision into one's work and vim into one's labor, but it can easily be carried too far.

The purpose of celebration is to stimulate service, but with some the idea of celebration is divorced from the idea of labor and is associated only with pleasure or idleness. At Marion, Ill., a traveling war exhibit recently laid the mines idle. As coal is in great demand and the cars to move it are needed even more, it is incumbent on every man to load cars whenever opportunity is provided and to exhibit his patriotism on idle days when that is the only service he can render. Celebrating will not win any victories. If we do too much of it now, there will be nothing but defeat to commemorate when the war is over.

Naturalization vs. Americanization

IT IS interesting to note that the campaign about to be put into operation for the Americanization of foreigners is not laying any stress on the ceremony of naturalization. Too clearly we are learning that this legal status is often given to people who have never acquired the spirit of America. They have not our heritage of democracy; they have not our patient spirit which seeks to progress from precedent to precedent; they are suspicious of our institutions, and many of them are illiterate and so unable to enter into the purpose of our laws or to understand our business relations.

We do not need any more such Americans. We are surfeited with them now. If we give them citizens' rights, we shall find they control us and not we them. Let all those who are not pro-American remain foreigners, till they are brought to a new and better mind. We should be slow to welcome them to citizenship, for they do not welcome us to their fellowship.

The movement for Americanization, however, is based on broader, better grounds. If it were not we would do far better without it. The leaders of the movement do not scheme so much to make Americans as to make pro-Americans. The republic would be safe with 75 per cent. foreigners if that 75 per cent. was ardently pro-American and imbued with friendship toward the other 25 per cent.; but if the proportions were reversed and we had 25 per cent. naturalized foreigners whose only affiliation with America arose from an oath taken under economic or physical pressure, or even under earnest persuasion, the republic would be in considerable danger of disruption.

Americanization is a slower process than what we speciously term "naturalization." We can "naturalize" in an hour. Americanization takes some months. We can "naturalize" with a little violence, but it takes the rarest

sympathy and tact to Americanize. But like all things expensive and slowly acquired, Americanization is worth all that it costs in time, money and trouble.

The enemy alien is just now peculiarly susceptible to Americanization, especially if he is not of Teutonic but of Magyar, Slovak, Czech or Serb stock. He knows that in most countries he would be treated with far greater severity. If he is reasonable he realizes that he is being used with exemplary indulgence. He is ready therefore to become pro-American if only a little impulse is given. He cannot become an American. Few care much that he should. If we have his heart and his hand who cares if we are deprived of his ballot?

As for the alien from an allied nation, we could not find a better time to bring him under the spell of our affection whether he be Italian, Russian, Irish or British. But we do not do well to ask him too sedulously to seal that affection with a bond, nor will we make headway with him if we too suspiciously urge upon him on every available occasion that in the words of Charles Dickens: "Codlin's your friend and not Short."

Our readers will pardon the following simile: The care of a child passes to a foster mother, a mother whose care is perhaps unremitting, but whose justifiable pride refuses to be hidden. She tries to ingratiate herself with her protégé by suggestions that his former mother was not as generous, sympathetic and beneficent as is his foster mother. The suggestion is not tactful even when true.

Unfortunately, we do not always see Americanization in that light. We are continually asking for pledges and persistently urgent in the question "Don't you like America better than Transpontiana?" It suffices if we punish disaffection and disloyalty. Positive declarations of affection if obtained by pressure are apt to foster the very spirit we seek to quell. Patriotism is an affection of the heart; it has been the great offense of the Germans that they tried to plant that delicate flower in alien soil by dint of forced naturalization and repressive measures.

Lengthening the Worker's Stride

IN SOME companies the number of men who subscribed for the Third Liberty Loan formed a large percentage of the whole force employed, but it still seems possible to improve the record a little. If the 40,000,000 wage earners in the United States buy a $50 bond, the amount raised is only $2,000,000,000, about one-tenth of what we shall require annually when we get our war stride and half what we are raising by taxation. If, as was the case in the Third Liberty Loan, only 17,000,000 subscribe, the amount raised by a $50 subscription would be only $850,000,000, quite a little less than a billion.

For this reason it seems that the size of the taking has not been sufficiently emphasized. In some companies the subscription came so close to $50 per employee, though all subscribed, that assuming that no one bought more than $100 worth of bonds the number of men buying two bonds apiece cannot have been more than 6 or 10 per cent. of those buying $50. It seems therefore that the canvass was conducted on the supposition that $50 was all that a workman could or should be expected to take.

There are not a few stories told of men who came to the boss and asked to buy a bond. The employer offered to sell him a $50 obligation and the workman, not satisfied, finally demanded one of a $1000 denomination. In one case a boy turned in his father's order, and when the manager was informed he summoned the old man to the office, bent on explaining to the foolish fellow that he could never pay for a $1500 bond by installments from his slim pay. The workman however closed the argument by producing from the lining of his coat a roll of bills which was more than sufficient to buy all the bonds his boy had contracted for.

The operator needs a little more faith. He does not yet know the splendid spirit of the men whom he commands industrially. Unfortunately he too often comes in contact with the mere wastrels of the mines, but the main body of the men have the interests of their family, the country and the company at heart. Loyalty is a virtue they have in abundance. The operator has had many a time to fear that spirit of loyalty when it was used against him. It is now directed in favor of national unity and victory, and the miner is showing how powerful its appeal obsesses him, and if he is approached to buy in hundreds of dollars, that is how he will buy; for he never was a quitter.

Give Till It Hurts?

ONE of our national organizations for war relief has urged that we give till it hurts. But giving doesn't hurt. If you doubt that statement just look at the givers. They are the happiest, heartiest, liveliest and most desired of all our friends. Hurt? They are not hurt. The crabbed soul who never gave a cent, or gave it grudgingly and of necessity, is the man who is hurt; and that injury is vital. It has attacked the very soul of the man, and it can go no deeper. Slowly, all that was best in him has been destroyed. It is not giving, it is refraining from gifts that hurts.

The American Red Cross is making a drive for $100,000,000 for war-relief work. The men who are making the call—we purposely do not term it an appeal—the men who are making the call are business men, and they ask a generous people for generous gifts. They are in touch with the American heart, and they know it is not the shriveled organ of a curmudgeon. They do not come to us each month with a new appeal, but ask us for enough to keep them going handsomely for some months. And the American people, capitalists and workingmen, will not deny them.

No body is all heart. The human heart is but a part of the human body. Similarly, the whole body of American people is not all heart. There are a few among us who do most of the giving. From them the American nation receives its glory and the American flag its luster. They must give, not a fair share, but an abundant share. The factor of safety for them must be not one, but ten, or this great donation will not be fully subscribed.

Therefore give—not till it hurts—but till it helps, till an allopathic dose of giving clears the foul humors from your heart and brain, and leaves you convalescent from your surfeit of self-indulgence. By thus giving you can help our boys and at the same time help our land to beam with the happy smile of the generous giver.

DISCUSSION BY READERS

Men in Blind Alleys

Letter No. 3—I agree wholly with the ideas advanced by "Lumen," *Coal Age*, Apr. 6, p. 644, in regard to men who continue to live in "blind alleys."

In my opinion, every man is the architect of his own fortune. When one is content to live in a blind alley he is in a rut. Such a man makes no effort to get out and travel a new road or explore a new country, so to speak. I want to indorse the sentiment already expressed, that every worker in this country, today, must study the theory of his work. It is a great mistake for a young man to be so indifferent to his future welfare that he neglects to study the principles underlying his occupation.

Whether a man works in an office or in a mine, he has the same chance to advance and gain a higher position, from month to month and year to year. Employers are not slow to recognize that the men who study do better work, make fewer mistakes, and the cost of production is reduced, because more work is accomplished in the same time. This is true of all work outside or inside of the mine.

Let me say, in closing, that to every young man there comes the opportunity to climb. The ladder is before him, but he must mount it step by step before he can gain the top.

C. MCMANIMAN.

Rawdon, Quebec, Canada.

Transportation of Coal by Canals

Letter No. 1—I was deeply interested in reading the article of W. W. Wotherspoon, state superintendent of public works, entitled "The Canal as a Carrier of Coal," which appeared in *Coal Age*, Mar. 2, p. 402.

The author of the paper says, "It is believed coal may be profitably transported in large volume via the canal at a rate of two mills per ton-mile."; but he does not tell how he arrives at that figure or what such estimated cost includes. It would be of interest to know if the expense of returning the empty cars to the mines is included.

In order to reach a right conclusion, one should know what the actual cost of transportation is, including maintenance and repair of the canal, and the locks and dams, and what is needed to cover interest and sinking fund charges on the bonds issued by the state to pay for the construction. If this two-mill rate does not include all of these items, then the public, or at least the taxpayers of New York State, indirectly pay a large part of the transportation cost of the coal.

That this was feared by the taxpayers of the farmer class is shown by an editorial in a recent number of the *American Agriculturist*, which says, "it has all worked out as the farmers of New York State feared some years ago when they voted so heavily against the bond issue. We showed that the canal, being mainly of national concern, should be improved by the nation. But the cities of the state overrode the farmers and the money was voted, the cost advanced 50 per cent. and the farmers' property will now be taxed for years to come, to pay heavily for the most colossal mistake ever foisted upon the taxpayers of the Empire State."

Kindly let me suggest to Mr. Wotherspoon that if the two-mill rate, per ton-mile, does not include the factors I have mentioned and the cost of carrying, the coal must then be paid for by the public, in the shape of taxes to cover these items, it would be of interest to have him revise his figures so as to include them and make the results public.

I fully believe that the public and the taxpayers of New York State, are entitled to know what is the *real total transportation cost* by canal, as well as the cost of the operation of the boats. With regard to this phase of the question, the following extracts from the Final Reports of the National Waterways Commission are enlightening:

> The amount of traffic available with a given equipment affects the cost of transportation by water in much the same way as it does the cost by rail. In both cases there are certain fixed costs on which interest must be paid, regardless of the amount of traffic moved, so that an increase of business, with the same equipment, results in a rapid decrease in cost per unit.
>
> When the waterway is a canal and is intended to be self-supporting, the analogy is perfect; but the same principle should apply to expenditures for the improvement of rivers. In determining the cost of transportation by water, each ton should be charged with its proportion of the cost of the improvement, even though in actual practice the expense is borne by the Government.

COST OF TRANSPORTATION ON THE ERIE CANAL

The report then goes on to say regarding transportation rates and costs on the old Erie Canal:

> The average rate, per ton-mile, on the Erie Canal, is about 2.45 mills. Comparing this with the average freight rate, it is frequently stated that the cost on this canal is about one-third of that by rail. But no such exact comparisons can be made, for the reason that the rates compared do not include the same elements of cost. . . .
>
> The average cost of transportation on the Erie Canal includes only the bare cost of conveying the traffic, plus a small return on the equipment used. It contributes nothing for the maintenance, nor does it make any return on the capital expended for the construction and enlargement of the Canal. Both these expenses are paid by the State of New York.
>
> It has been conservatively estimated that if the canal traffic was charged with a toll sufficient to cover these additional expenses the rate, per ton-mile, would amount to 8.61 mills. The average rate for similar commodities, especially on the railroads in New York State, is probably not more than five or six mills, per ton-mile. . . .
>
> Any comparison between cost of transportation by rail and by water will be of value only when the two rates include similar elements of cost. Few such comparisons have ever been made.

The statements here quoted were made with reference to the old Erie Canal, which, according to the authority

of A. Barton Hepburn, in his book "Artificial Waterways and Commercial Development," cost $49,591,853.

If the figures given above, showing a cost of 8.61 mills, per ton-mile, on the old canal, which cost in round numbers fifty million dollars, are correct, how can the new canal, costing over three times that of the old, be operated at a rate less than one-quarter the cost, per ton-mile, on the old canal, when all the proper charges entering into the cost of operation are taken into account?

Can it be denied that if coal can be transported on the new canal at two mills, per ton-mile, with a profit to the boat owner, it is because the taxpayers of New York State pay all the other items mentioned above that go to make up the real total cost of operation? Would not this be equally true, even if the canal had been constructed by the National Government, as suggested by the editor of the *American Agriculturist*, except that all the transportation cost, over the actual cost of the operation of the boats, would be borne by the public at large, instead of the taxpayers of New York State?

Pittsburgh, Penn. W. G. WILKINS.

Mining Equipment

Letter No. 4—The letter of P. K. Howard, *Coal Age*, Apr. 13, p. 710, drawing attention to the importance of providing better axles for mine cars, interested me greatly, because for years I have felt that mine superintendents were restricting the capacity of their mines by the use of low-grade equipment.

Not being a technical man, I frequently fail to understand the details of the heat treatment of steel axles, such as advocated by Mr. Howard. But, as a stockholder in several important mining operations, I constantly visit the coal mines, and have often been impressed by the seeming loss in efficiency and the comparative short life of the average mine equipment.

This is largely due to the low-grade materials used and the fact that many mining companies, in buying equipment, hold the manufacturer to their own specifications. In many cases the manufacturer, by reason of his better knowledge of the proposition, is in a position to furnish much superior equipment at the same price if he was allowed to follow the methods and plans that his experience has shown him to be the best.

USE OF LOW-GRADE MATERIAL IN MINE EQUIPMENT

My impression gained from personal observation and by talking to practical mining men, is that the general run of equipment used in coal mines today is of a lower grade than that used in any other industry that is as important as that of coal mining. Every year sees tremendous strides in the improvement of machine tools. Careful redesigning, based upon experiment and continued research, suggest improvements in the kind and quality of material used, all of which goes to speed up the work produced by machine tools and makes it possible to turn out better tools at a lower cost for labor and there is less depreciation of equipment.

In the average coal mine of today, however, one can find mine cars that are essentially the same in design and materials as those used in the earlier days. But, as Mr. Howard says, this state of unprogressiveness is not the fault of the mine-car manufacturers, who are frequently in a position to supply a higher grade of equipment, but are forced by the demands of the operators to furnish cars of inferior material and design, at a low price.

DESIRE TO REDUCE FIRST COST

It is my honest opinion that the men who are responsible for the purchase of new equipment, are giving too much of their attention to the first cost of the mine cars they require, and disregard the ultimate cost, which is caused by the labor and materials used in making frequent repairs, the time lost when cars are in the shop and the depreciation charges, which are abnormally high on short-lived equipment. Any man who has ever tried it knows that one good suit of clothes will outwear three cheap suits and give much greater satisfaction throughout its useful life.

I am glad to learn from Mr. Howard's letter that heat-treated axles are being used by some of the far-sighted mine opertors, and believe that the coal-mining industry will benefit greatly by the constant improvement in the design and material entering into the construction of mine cars. Any results that practical mining men have obtained from the use of heat-treated axles and other improvements in car designs would certainly be of benefit to other mining men and all should come forward with their experiences.

An authorative article by an expert on steel for mine-car bodies and running gear could not fail to be of value to men who realize that their mining equipment should be improved, but who hesitate to change from their old style of equipment, because they do not know the possibilities of superior material and modern design.

Washington, D. C. MAVERETT ASHLEY.

Letter No. 5—I agree thoroughly with "Progressive" when he urges, in his letter, *Coal Age*, Mar. 9, p. 468, that coal operators who have bought and used certain types of mine equipment should discuss their merits and demerits for the benefit of the industry. The experiences of users must serve as a guide to prospective buyers, and this applies to all classes of mining equipment. The discussion of the actual performance of equipment it is desired to purchase is indeed most valuable to the prospective buyer.

Coal-mining executives, as a rule, however, decline to discuss the benefits received from the use of a new machine. *Coal Age* has, from time to time, called attention to the fact that the columns of the paper are always open for a discussion of this kind; but mining people have not generally availed themselves of this offer.

Letter No. 2, which appeared Apr. 13, p. 710, calls attention to the fact that coal operators hesitate to express their views for fear of giving away valuable information. Let me say that any manufacturer of worthy equipment should welcome a full and free discussion of the worth of such equipment when written by users.

Since this is not done, however, it remains for manufacturers to resort to advertising and personal solicitation in order to reach the probable prospect. Letters of endorsement substantiate the facts set forth in this way, and they are worthy of the most serious consideration on the part of people contemplating the purchase of the

equipment or product described. Such a letter is not given as a result of one or two days' trial; but, instead, after the equipment or product has undergone a severe trial and the user is convinced of its real worth.

It is to be hoped that operating officials will relate their experiences with mining equipment for the benefit of those who contemplate purchasing. Particularly is this true of roller-bearing mine cars and storage-battery locomotives.

In the same issue of *Coal Age*, page 710, P. K. Howard, speaking of mine equipment, discusses the use of heat-treated axles on mine cars. From my own observation, the use of heat-treated axles on mine cars has never been considered by the coal operators, in the bituminous fields of Pennsylvania, West Virginia, Ohio and Maryland. However, the adoption of 5- and 6-ton cars to take the place of the 1- and 2-ton cars formerly used, may make it necessary to use heat-treated axles, on these larger cars. But, their use can only be brought about as the result of education on the part of advocates of this type of axle.

Cars holding 6 tons of coal are used in the anthracite region of Pennsylvania, and these are subjected to severe service; whereas the cars used in the bituminous fields rarely hold more than 4 tons of coal, though they too are subjected to severe service.

I agree with Mr. Howard when he states that a discussion of this subject will prove of untold interest to coal operators. For myself, I must profess ignorance on the subject of heat-treated axles for use on mine cars and, for that reason, hope that someone will furnish light and illustrate the subject with sketches or photographs. K. J. WALTERS.

Pittsburgh, Penn.

Gathering Motors

Letter No. 2—In these days of national crisis, the mine operator and management are confronted with the ever-increasing cry, "Produce more coal." Every practical mining man knows that the installation of a successful haulage system, in a mine, goes a long way toward meeting the demand of increased production.

In this connection, I have been greatly interested in the several articles that have appeared in recent issues of *Coal Age*, regarding the storage-battery locomotive as being the best adapted to the gathering of coal at the working face. The merit of a mechanical haulage system over the old fashioned practice of mule haulage is freely admitted by practically all mining men of experience who have made any study of the haulage of coal in mines.

However, while admitting the advantages of mechanical haulage over mule haulage, I am hardly prepared to go as far as some claim, in respect to the comparative merits of the storage-battery locomotive and the trolley system of haulage. To my mind, each of these systems has its peculiar adaptation to different mining conditions, and they can hardly be regarded as belonging to the same class.

My experience convinces me that the trolley system of haulage is well adapted for use on the main haulage roads in mines, while the storage-battery locomotive is particularly fitted for the gathering of coal from the working face and placing it on the inside parting, in readiness to be hauled out of the mine.

The work of gathering was formerly done by mules, but so successful has been the use of the storage-battery locomotive at the face that it can be predicted, almost with certainty, that the mine mule will soon be relieved of his burdensome life in the mine, and permitted to pass the remainder of his days in a more congenial atmosphere.

STORAGE-BATTERY LOCOMOTIVES USED ON MAIN HAULAGE ROADS

I do not wish to be understood as restricting the storage-battery locomotive wholly to the work of gathering cars at the face. In my opinion, in a large number of instances, this type of locomotive can be used with decided success on main haulage roads. The operation of the machine is so simple as to require no mechanical ability worthy of mention. It can be much injured by neglect and carelessness; but, with proper care in its operation and with suitable attention to the batteries and an occasional inspection of all working parts, the cost of upkeep will be reduced to a minimum and the efficiency of the machine maintained at a maximum.

In a number of mines recently visited, I have been greatly impressed with the working efficiency of this type of motor. A number of those observed I found were built by the Ironton Engine Co., of Ironton, Ohio, and it gave me pleasure to note the ease with which they were handled and how much they increased the general efficiency in the production of coal. SPECTATOR.

Meyersdale, Penn.

Letter No. 3—I read with much interest the letter by "Motorman" of Herrin, Ill., *Coal Age*, Apr. 27, p. 800, and desire to offer a few comments on his suggestion recommending the combination battery-and-trolley locomotive as being desirable for use in the mines. The several letters that have appeared recently in *Coal Age*, regarding locomotive haulage in mines have been very good and practical. They should prove a great help to coal operators and mine foremen, in choosing the system of haulage best adapted to their needs.

My personal opinion in regard to the combination battery-and-trolley locomotive, recommended by "Motorman," is directly opposed to that expressed in his letter. I have investigated a number of designs of this type of locomotive and observed its performance under different conditions in mines, and conclude that the combined type is not practical.

WHY COMBINED BATTERY AND TROLLEY OPERATION IS NOT PRACTICABLE

In the first place, a locomotive operated by trolley or battery must have sufficient motor capacity for the given weight. This capacity, we will say, is, at least, 10 hp. per ton, in order to utilize the full tractive effort of the machine and avoid the slipping of the wheels on the rails. But, it is not possible to find a storage-battery locomotive with this capacity of motor, whether the machine is equipped with a pole or not.

My claim is, therefore, that the motor capacity of a storage-battery locomotive is not suitable for use on a trolley system, and such a machine cannot be adapted to that work by simply equipping the machine with a trolley pole. If the motors are made efficient for bat-

tery work, they are not suitable for good operation on trolley work; and if they are made of suitable capacity for operation by trolley, they will prove very inefficient for battery work.

Again, the combination trolley-and-battery locomotive is more complicated than the trolley machine, and would require to be looked after by the mine electrician. Also, the machine is more susceptible of abuse by the motorman, because of the battery being overcharged or discharged and run at exceedingly high temperatures.

Essential Features of Battery Locomotives

The best form of storage-battery locomotive, for gathering purposes, therefore, is one whose motors are designed for storage-battery work, having a low internal resistance and low iron loss. The machine should be designed to give equal efficiency at one-quarter full load as at full load. In other words, the losses in the motor should be so balanced that the motor will be equally efficient when hauling light or heavy loads.

The battery should have sufficient capacity to complete the necessary work of a full shift, so that all the charging, filling, cleaning, etc., can be accomplished at the battery-charging station where proper facilities are provided for that purpose, including switchboard and other measuring instruments.

While there are some practical installations of combination battery-and-trolley locomotives that are highly successful, such installations are not generally recommended because the simplest possible combination of mechanical and electrical parts, as we all know, are required in coal-mining conditions. In this connection, allow me to present the following little burlesque, which was written by a friend of mine when these locomotives first appeared on the market.

Columbus, Ohio Edison Marconi Ampere.

The Wonder Mfg. Co.
Cincinnati, Ohio
Gentlemen:—

I got your letter askin did the new combinashun troley and battery locomotive run. It does. When we got it we put it on the new circular track in no six entry and Bill Stevens which is our best motorman wanted to show off and he got on the locomotive and there is so many little hickies and dewdads on the durn buss an Bill evidently didnt know as much as he thought he did and he got bawled up and must have jimmied something and jammed the rong lever for the locomotive run steady through 19 shifts or nearly six days the track is circular as i sed before and when the battery run out the durn thing hit the troley wire and charged up the battery again and the locomotive stept along a little livelier and we were afraid we would have to shoot Bill to keep him from starving to deth.

Some ginnie in the power house tried to shut the power off and he hit the rong switch and we had forth of july and the last daze of pompey simultaneously and to oncet. We gobbed the ginnie. The locomotive kept on goin til it run off the track and Bill went up in the air and came down on the hot resistance burning his pantz an swore awful. When we got the locomotive in the charging shed say Bo you ought to have saw that battery it looked like a piece of limburger cheese what some one had carried in their hip pocket in hot weather it was some mess believe me. We had volts and kilowatts scattered around all over the place to say nothing of ohms. The locomotive is not what you call a success at least not on no circular tracks with a green motorman.

Yours truly,
Juan Hrdlika Pit Boss.
Circle City, Skiddoo County, Colo.

Selection of Mine Timber

Letter No. 1—Since reading the inquiry that appeared in *Coal Age* [Dec. 29, p. 1113], regarding the size and kind of timber required in mines, I have become much interested in the selection of timber that is best adapted to mining conditions, in respect to both the strength and life of the timber.

As is well known, the timber required in mines for different purposes, such as props, crossbars, caps, trackties and lagging, ranges from mere saplings to large logs varying from 20 in. to 2 ft. in diameter. In the selection of mine timber regard must be had to the use intended, as all timber is not equally strong or equally durable under the severe conditions to which it is subjected in mining.

Timber that is not properly seasoned or dried before being taken into the mine may develop dry rot or be rapidly destroyed by fungus growth or worms. For mining use it should be cut in the winter season, say from the last of November to the first of March. During these three months of the year the sap has practically drained from the wood, and timber cut then is more readily seasoned for use.

When the trees are felled they should be cut at once into lengths suitable for use as props, crossbars, ties and lagging, while all waste ends should be split for cap-pieces to avoid undue waste. The cut timber should be stacked on end, in piles, to aid the process of drying, and the brush piled and burned.

In general it may be stated that the best timber is to be found on high ground where its slower growth develops greater strength in the wood. The weaker timbers, for the most part, grow on low ground where the moisture affords a more rapid growth.

The principal woods used in mining are the following: Oak, hickory, pine, cedar, spruce, tamarack, hemlock and cedar. These make the best mine timber, because they possess greater relative strength and durability than most of the other woods found in the states and Canada. Probably the strongest and most durable of the timbers named are the oak and hickory, which are commonly classed as hard wood. Allow me, now, to briefly summarize the character of each kind of timber named, as follows:

Character and Qualities of Mine Timbers

Oak—There are a number of different kinds of oak, as white oak, red oak, black oak, etc. These differ mostly in color, texture and grain. The white oak, so largely used in mining, is a heavy, hard and strong wood of a close, straight grain. It is used chiefly on main airways and haulage roads where timber of greater strength and durability is required. The red and the black oak are both softer and more porous than the white oak but still make excellent mine timber.

Hickory—This, also, is a heavy, hard and tough wood. Good, sound hickory is stronger than oak. The wood, however, is not durable, and its use in mines is chiefly limited to the timbering of rooms where the life of the timber is not so important as on the haulage roads and airways.

Pine—This is a good, light, soft wood that is easily handled and cut for use in the mine. It is straight

grained, comparatively free from knots and fairly durable. It is much used in lining shafts, building doors, air bridges and brattices in mines. When well seasoned it makes good prop timber and cap-pieces.

Spruce—Like pine, this is a soft, straight-grained light wood that is useful in the mine. It is slightly less durable than pine timber, being subject to dry rot, which may be largely prevented by chemical treatment. The variety known as white spruce is remarkable for its clear satiny appearance from the bark to the center. The spruce tree has many branches, which make the wood knotty and of inferior strength.

Tamarack—This is one of the most durable of all mine timbers. It is frequently found in the vicinity of lakes on low or middle land. In appearance it resembles the spruce with the exception only that, unlike trees of this class, it sheds its leaves in winter. The sapwood is white for about an inch in depth, while the remaining heartwood is a dark red in color. Tamarack makes an excellent mine timber. Its strength is almost equal to that of oak, and it breaks more slowly.

Hemlock—This is a soft but brittle wood of a coarse, uneven grain. It is light but not durable. When used in mines it is chiefly employed for props in rooms and for cap-pieces. Because it breaks quickly without warning, it is of no value for crossbeams or collars.

Cedar—This is a favorite wood in mining, because it is soft, light, with a generally fine texture, straight-grained and durable. The best cedar is not subject to dry rot. This variety is known as mountain cedar and is preferable to the growth found in valleys or swamps, which has a coarser grain and develops dry rot at the center. Valley cedar, however, is much used in room-work and in longwall mining, because it is easily worked to size.

Other soft woods used to a limited extent are the beech, chestnut, elm, locust, poplar and walnut. With the exception of the locust and walnut, these woods are much too soft and lack the necessary durability.

Rawdon, Que., Canada. C. McMANIMAN.

Mass Education Needed

Letter No. 3—There comes a time in the history of every nation when it becomes necessary to take account of its many activities, in order to ascertain its stability as a going concern, estimate on its rate of progress and determine what means of improvement there are in respect to future operations. It appears to me that such a time has arrived in respect to the education of men employed in the mining of coal in this country.

In the past, mining education here, has been confined very largely to the training of colliery officials. As a rule, little attention has been given to the education and training of the general body of workers on whom the safety of the mines so largely depends. Every boy and man employed underground and ignorant of the many causes of danger is a menace to safety—a state of things that ought not to be allowed to continue.

No system of education is complete that does not provide for the training of young workers to appreciate the dangers of their occupations and their individual responsibilities. The educational ladder, so to speak, must be so complete as to permit any intelligent man to gradually mount, step by step, until he has reached the top.

Mining classes should be in the hands of capable and sympathetic teachers, who should be supplied with the necessary books and apparatus to enable them to teach the underlying principles and make the course of study a practical one. The work should receive the hearty coöperation and assistance of the mine officials who should realize the increased efficiency and safety to be derved from this source.

When proper attention is given to the matter of education, there should be no difficulty experienced in securing the attendance of the majority of young men, in any mining district. The enthusiasm aroused by those attending the first session should be a strong factor in bringing others into the classes, which should include the study of English, drawing, practical mathematics, physics and chemistry.

Although the movement to educate the great body of mine workers is now widely established in the larger mining towns and districts, many of the smaller camps are without these advantages. It is a mistake to attempt to teach experimental physics or practical chemistry relating to mining, by means of a piece of chalk and a blackboard, as is still frequently done, with the result that interest lags and little good is accomplished.

Students Should Be Taught How to Perform

The teaching of science should be closely associated with the actual doing of what is taught. A man may know many things wthout beng able to do one of them. The mathematics taught ought to be such as can be applied to the working of practical mining problems and this should constitute the method employed in teaching. The same applies to drawing.

When the student has been taught how to handle his instruments, and the difference between a plan and an elevation or cross-section has been explained, and the purpose of each made clear, he should be drilled in acquiring accuracy and speed, in making simple drawings of such objects as he is familiar with in his work. In other words, the course should form a part of his mining training and not considered as a preliminary study to enable the student to gain a knowledge of things without performing the work.

Were this scheme of practical training generally adopted, not only would the mines be safer, but the work would be more efficiently done and the mining of coal would be a better investment. In my opinion, mine officials make a mistake in demanding the long hours the miner must work underground. Better work would be done in less time if a portion of these long hours were to be devoted to the training of men in practical work. Where a man is compelled to work from 12 to 13 hours a day, he has little ambition or time for study and training.

Observation would seem to show that there is far less interest being taken by many mine officials in the anthracite region today than was exhibited a few years ago. Some of these men are paid a lower compensation than the men who work under them, and this may be one cause for their discouragement and lack of interest in the work of education among their men.

Plymouth, Penn. JOSEPH R. THOMAS

INQUIRIES OF GENERAL INTEREST

Chart for Estimating Change in Declination of Sun

Kindly allow me to refer to the interesting chart given in the article describing the Ross meridiograph, *Coal Age*, Apr. 20, p. 732. The chart appeals to me as somewhat better than the one with which those who have used the meridiograph are familiar, and I am anxious to know how it is constructed.

It has occurred to me that the average engineer does not cover more than, say 10 deg. of longitude, and many are limited to the half of that. My idea would be to construct a chart on a larger scale arranged to read minutes of longitude and half-hours of time, besides drawing the declination lines for each degree or half-degree of declination. Kindly explain. H. M. K.

———, Penn.

The chart referred to by this correspondent is a simple diagram for estimating the change in apparent declination of the sun, for any longitude east or west of Greenwich and for any local time of observation, between the hours 9 a.m. and 4 p.m. The estimated change is that which has taken place in the sun, counting from Greenwich noon to the local time of observation.

By way of explaining the construction of the chart, attention is first drawn to the fact that the rate of change in the sun's declination varies with the angle that the plane of the ecliptic makes with that of the equator. A reference to the Ephemeris shows that the declination changes 23.7 min. in 24 hours, at the equinoxes, while at the solstices the change, in the same time, is practically zero.

As there is no appreciable error in assuming that the change in declination is uniform for 12 hours, a diagram is constructed on a pair of coördinate axes, by laying off the change, in minutes, for each degree of declination, as abscissas; and the corresponding time, in hours, as ordinates. This will explain how all the declination diagonals start from the origin of coördinates at the lower left-hand corner of the diagram. For the sake of convenience only, the vertical line in the diagram, representing the meridian of Greenwich, is marked 11.85, which is the maximum change in 12 hours, and the diagonal for a zero declination is drawn to that point. The scale of minutes is then divided accordingly.

The next step, after marking off this scale, is to find from the Ephemeris the amount of change in 24 hours, for any desired degree of declination, by subtracting two consecutive declinations embracing that degree, as given in the table. One-half this difference is the change for 12 hours, and the diagonal for that declination is then drawn from the origin of coördinates to the point, in the declination scale, corresponding to this change. In like manner the change in 12 hours for other declinations is found and the diagonals drawn.

For example: To find the change in 12 hours for a declination of 10 deg. Referring to the Ephemeris for 1917, which can be used with no appreciable error for a period of 10 or 15 years, the declination for Feb. 23 is given as 9 deg. 55.8 min., while that for Feb. 22 is 10 deg. 17.7 min. The difference between these two declinations (21.9 min.), divided by 2, gives the change in 12 hours, for that angle of the ecliptic as 10.95 minutes.

The next step in the procedure is to determine the time that has elapsed from Greenwich noon to the local time of observation. Clearly, this difference in time is made up of two parts: (1) The difference between local noon and Greenwich noon, which is 1 hour for each 15 deg. of longitude; (2) the time of observation, before or after noon. Hence, each hour diagonal must start from the corresponding hour on the meridian of Greenwich and incline upward at the rate of 1 hour for each 15 deg. of longitude.

From this construction it is clear that following the hour diagonal corresponding to the local time of observation to its intersection with the given longitude gives the proportional rise vertically above the datum line or horizontal axis and divides the declination diagonals, each in the ratio of the estimated difference of time to the full 12 hours of the declination scale.

Most engineers will agree that there is no advantage to be gained by constructing a local chart to cover, say 10 deg. of longitude. This can be done, if desired, by following the same method of procedure as that just explained. The chief difficulty encountered in the undertaking is the length of the chart vertically.

For example, to enable the accurate reading of the chart it is necessary that the hour diagonals cross the horizontal lines at an angle that will clearly define their intersection, say 25 or 30 deg. The difference of time for 10 deg. of longitude is two-thirds of an hour. Then, if the hour diagonals incline at an angle whose tangent is 0.5, two-thirds of an hour, on the vertical axis, will be one-half the length of the horizontal scale; or 1 hour on the vertical scale will be three-fourths of the width of the chart.

Starting the 9 a.m. diagonal from the lower right-hand corner of the diagram, and terminating the 4 p.m. diagonal in the upper left-hand corner, will make the height of the chart ($7\frac{2}{3}$ hours), $7\frac{2}{3} \times \frac{3}{4} = 5\frac{3}{4}$, or nearly six times its width. This, again, would make the declination lines present too close a parallelism with the vertical lines and make the accurate reading of the scale difficult.

When one considers that the maximum change in declination is only, approximately, 1 min. of arc in an hour; and the difference of time is 1 hour for 15 deg. of longitude, it is clear that there is no need for a closer approximation than the original chart affords.

EXAMINATION QUESTIONS

Bituminous (Penn.) Examination, Apr. 11-12, 1918

(Selected Questions)

Ques.—State where and under what conditions it is unlawful to use an open light in the mine.

Ans.—The bituminous mine law of Pennsylvania (Art. 10, Sec. 1) prohibits the use of open lights "in any entry, airway, travelingway, room or any other working place where explosive gas is being generated in such quantity as can be detected by an approved safety lamp; also in pillar workings where a sudden inflow of explosive gas is likely to be encountered.... [Also,] in all working places, roadways, or other portions of the mine through which explosive gas might be carried in the air current, in quantities indicating danger."

The same section further authorizes the mine inspectors, with the approval of the court, to prohibit the use of open lights in any section of the mine that, in their judgment, should be worked exclusively with locked safety lamps. Sec. 3 prohibits the use of open lights in the return air current of any portion of a mine where locked safety lamps are used.

Ques.—Are regulators necessary in the ventilating of coal mines, and, if so, where should they be placed, and why?

Ans.—The use of regulators is necessary, in the ventilation of any section of a mine, where more or less air is required than the quantity that is provided by the natural division of the current. Regulators must be placed in those splits that offer less resistance than what is required to provide the desired distribution of the air. As far as practicable, all regulators should be located either on the back entry or at the mouth of the split, but in such a position that they will not obstruct the haulage roads in the mine.

Ques.—After you, as fireboss, had completed your examination of a mine, how would others know you had examined all the working places? If you discovered danger, how and where would you place your danger signals?

Ans.—The mine law requires that the fireboss shall mark the date on the face and side of every working place examined, as evidence that he has performed his duty. The law further requires the fireboss to enter, with ink, the results of his examination, in a book kept for that purpose. This entry must be made immediately after the examination is completed and must show the time taken in making the examination and the nature and location of any dangers that may have been discovered. The fireboss must place a suitable danger signal across the entrance to any place where danger is discovered, and remove the danger sign from the mine entrance, showing that it is safe for men to enter for work.

Ques.—What instructions would you give workmen in regard to their safety, and what action would you take to see that your instructions were carried out? Explain fully.

Ans.—Every workman should be made to understand that he is personally responsible in the matter of securing his own safety and must report promptly any danger that he may discover in his own or any other working place. He must be instructed to withdraw from his place should danger develop while he is at work. He must report the same to the mine foreman or his assistant. The workmen should be instructed to obey promptly what orders are given them in regard to the timbering of their places or the mining of the coal. When intrusted with safety lamps, workmen should be given full instructions in regard to their use. The mine foreman and his assistant should visit the working places frequently enough to ascertain that their orders are obeyed.

Ques.—What is the pressure of one atmosphere equivalent to, in pounds per square foot?

Ans.—The normal or average atmospheric pressure, at sea level, is commonly taken as 14.696 lb. per sq.in. This is what is termed "one atmosphere," at sea level, and is equivalent to $14.696 \times 144 = 2116.224$ lb. per sq.ft. Or, taking the normal sea-level pressure as 14.7 lb. per sq.in., this is equivalent to $14.7 \times 144 = 2116.8$ lb. per sq.ft.

Ques.—What is the weight of a cubic foot of air, at a temperature of 60 deg., and a barometer reading of 29.5 in.?

Ans.—The weight of a cubic foot of dry air at a temperature t, in degrees Fahr., and a barometer B, expressed in inches, is calculated by the formula

$$w = \frac{1.3273B}{460 + t} = \frac{1.3273 \times 29.5}{460 + 60} = 0.0753 \text{ lb.}$$

Ques.—An airway 5 x 9 ft., 1200 ft. long, is passing 15,000 cu.ft. of air and gas per minute. The mixture contains one-half air and one-half gas. If one-half more air were added, what would then be the velocity of the current, in feet per second, and what would your lighted safety lamp indicate if placed in the current?

Ans.—The sectional area of this airway is $5 \times 9 = 45$ sq.ft., which gives a velocity when passing 15,000 cu.ft. of air and gas, $15{,}000 \div 45 = 333$ ft. per min., before any air is added. Since the original current is half air and half gas, there are 7500 cu.ft. of gas and the same quantity of air in the original current. After one-half more air is added, the volume of air will be $7500 + 3750 = 11{,}250$ cu.ft. The total volume of the current of air and gas is then $7500 + 11{,}250 = 18{,}750$ cu.ft. The velocity is $18{,}750 \div 45 = 416+$ ft. per min.

The percentage of gas in this current is $7500 \times 100 \div 18{,}750 = 40$ per cent. If a lighted safety lamp was introduced into this mixture it would be promptly extinguished by the gas.

COAL AND COKE NEWS

Harrisburg, Penn.

Arrangements to get greater service out of cars and railroad facilities in the handling of coal were made at a recent conference of Lehigh Valley R. R. and Lehigh Valley Coal Sales Co. officers in Hazleton. Shipments in solid trains are to be made up so as to avoid shifting.

The daily output of domestic sizes of coal from the Prospect colliery is to be sent to the Lehigh docks at Jersey City for transshipment to New England. If the output of this colliery is not sufficient for the purpose, that of the Dorrance colliery, or part of it, will be added to the Prospect shipment.

The Hazleton region is to furnish coal for the west to be taken from Drifton and Hazleton No. 1 collieries and the Hazleton shaft. Shipments are to be made four days each week. Egg, stove, chestnut and other sizes of anthracite going west are to be sent to Jersey City, Newark, and other points for distribution. This will greatly aid New York.

The action was decided upon following the notice sent out by the Director General of Railroads that solid trains should go from collieries to tidewater points in order to avoid the unnecessary shifting of cars by the railroads.

Holding that a man whose hands are frostbitten in the course of his employment is entitled to compensation, an interesting and important decision in the courts on May 10 sustains the decision of the referee allowing compensation. The decision promises to become a leading one in all states having compensation laws, also in Great Britain, as several English decisions are quoted and a difference pointed out to distinguish the phrase "in the course of his employment," as contained in the Pennsylvania law, and "arising out of the employment," as contained in the English law.

In appealing from the decision the defendant company had complained that frostbite was not compensable under the act of 1915, because the injury (1) was not received "in course of employment," and (2) was not "violence to the physical structure of the body."

Judge Fuller admits that both propositions are exceedingly close and that he found difficulty in reaching his conclusions. He proceeds, however, in a convincing manner to decide both in favor of the claimant and quotes American and British decisions to show that consideration of employer's lack of control of the weather and employee's lack of precaution were only pertinent on the question of negligence or contributory negligence, which the Compensation Act entirely eliminates.

Fairmont, W. Va.

A. W. Calloway, Director General of Bituminous Distribution of the Federal Fuel Administration, made some important statements at last week's meeting of the Fairmont Coal Club. Too large a percentage of the coal is not needed in the war program, was one of his declarations, which was followed by an intimation that if the present policy of the Fuel Administration did not solve the problems which confronted the Government there was likely to be some sort of a different arrangement before Christmas."

Mr. Calloway mentioned a growing insistence on the part of those controlling the war industries for what the Government classified as "No. 1" coal, and his remarks indicated that it was possible that coals which were most essential in war work would be given priority. One of the many trite statements with which he dismissed subjects which had given the local coal association much worry was that "priority assignment of coal was more important than the priority assignment of cars" in the "war program," to which reference was made on frequent occasions, which emphasized the fact that the war program took precedence in the workings of the Fuel Administration.

Mr. Calloway referred to the fixing of the price of railroad fuel and the doing away with the assigned car policy by a mere statement, not emphasized in any way, that the Fuel Administration and the Railroad Administration were dangerously near a break six weeks ago. The decision reached will benefit the war program, he insisted, and will not hurt the individual operator. He stated that the Fuel Administration knew what it was about when it insisted that the matter of railroad fuel contributed more largely to the war program than any other problem which had arisen, and made the point that every coal man was a part of the Fuel Administration and therefore interested in its problems.

Mr. Calloway said that it was unreasonable to permit the railroads to choose the best coal when other coal was almost as well suited for their purpose and the coal that was their choice was essential to the work of war industries.

If an equal distribution of cars did not solve the coal problem he thought readjustment necessary, and believed that mines producing "No. 1" coal, imperative in the demands of the war industries board, would be called upon to provide such coal under modified arrangements.

The idea advanced that the coal operators are a part of the Fuel Administration was new here. He supported the declaration by pointing out that the operators selected their own District Representative. Every operator had a right to protest, he said, in event that the District Representative erred, but in the event of no protest it was presumed things were working all right. He insisted that the inspection system was also in the hands of the coal operators. He took a more drastic attitude in this connection and said that if any man sent out coal not fit to be shipped with transportation conditions as they are at present, he does not deserve to be classed with coal men as now known and that such men ought to be "wiped off the earth" if necessary.

Charleston, W. Va.

Reports from all the coal fields in this section reached by the Chesapeake & Ohio disclose the fact that the car supply continues to improve, the supply averaging from 60 to 75 per cent. of total requirements or cars asked for, running as high as 75 per cent. in Raleigh County, where there are a very large number of operations. The same is true as to the New River District, where the percentage, however, is not quite so high.

Operators in the southern section realize that it will be necessary to materially increase the present output in order not only to meet the demands of war but to show a production greater than the last few years. The efforts of the coal mine owners to speed up production will depend upon two factors—cars furnished and the ability to secure labor. Questions have elicited the fact that miners are not putting in full time in the mines but are working only a fraction of the week and for only a sufficient period each week to meet their living expenses. Unless miners are awakened to the necesity of producing a greater tonnage, it will be impossible, operators contend, to reach the average and to forge ahead of previous marks. The loss in tonnage earlier in the year was very heavy owing to an inadequate car supply, and the tonnage shortage lost in that way must be overcome before the producer can hope to increase the output so as to make such production felt throughout the country.

While here and there in this section opposition to the zoning system is manifested, most of the operators and particularly those whose mines are in a field producing coal of a quality which always finds a ready market are reconciled to the zoning system, so long as it saves transportation and permits the steady movement of cars back and forth. This is particularly true as to the New River and Pocahontas districts.

For the most part the car supply in the Fairmont field was good last week, the region receiving 1458 cars on Monday, or nearly a full quota. On Tuesday the supply was somewhat less. However, the supply was sufficient throughout most of the week to create some enthusiasm and sustained hope of better conditions in the future.

Companies in this section are planning to make a record for coal loading during the week of June 3, which according to published statements is to be known as "Coal Week."

The first step in a move to extend the coal trade of West Virginia so that this state might compete with the Hun after the close of the war was taken last Wednesday, when coal men representing the various coal operators' associations of the state met in conference with Governor Cornwell at his office here to discuss plans for obtaining a wider market for West Virginia coal. Governor Cornwell opened the conference with a short address in which he alluded to German business methods and the necessity of introducing more efficiency into American methods if the American is to compete successfully with the Hun producer at the close of the war. He spoke of the possibilities which lie in the South American trade and dwelt particularly upon the necessity of introducing American coal and especially West Virginia coal into this trade. Once introduced, he said, America would be able to hold the trade because of the superior quality of American coal.

Birmingham, Ala.

A new stripping coal mine will be added to the list of Birmingham mines within the next 15 days, it is officially announced. This mine is located in the Blue Creek region in the southern part of Jefferson County. J. C. Maben, president of the Davis Creek Coal Co., is directing the new project. Machinery, including steam shovels, is now being placed and coal about 12 ft. thick will be worked.

Modernizing of present blast furnaces, in time, building of new furnaces, construction of a byproduct plant and other developments are said to be included in ultimate plans of the Sloss-Sheffield Steel and Iron Co., discussed last week by President J. W. McQueen with the chairman of the Board of Directors, Waddill Catchings, in New York.

While great trouble is being experienced in getting material, which may serve to retard to a slight degree the work contemplated, the plans are to be carried out in relatively short time, it is reported. The contemplated improvements, it is estimated, will represent an outlay of several millions of dollars.

The coal-mining district at the close of the present week has a larger number of men at work than ever before, but the percentage of increase in production is rather disappointing. Investigations, however, fail to determine whether this condition is due to a "laying-off" on the part of the miners during the week or because of a deficiency in the labor.

The tonnage is increasing, but none too rapidly, for there are demands coming in from all sides which are not being met promptly. Accumulation of coal for next fall and winter, as suggested by the Fuel Administrator, has not yet started in, and there is doubt expressed among the producers whether there can be a great amount of coal put into bins or other places for use next year.

Miners and employees at mines begin this week at the new wage scale, advances in tonnage and day scales having been granted all along the line. The miners get 5c. additional for mining, while the day labor will receive a greater per cent. increase.

PENNSYLVANIA

Anthracite

Georgetown—By spreading the burning culm over a flat surface and covering it with sand and clay, the Lehigh and Wilkes-Barre Coal Co. has started to extinguish a fire which has raged for months on a large culm bank between the Blackmand and Stanton collieries.

Plains—Fear of extended caving of the mining property of the White Coal Co. at Pittston has caused the operation to remain in idleness since early last week, when 20 homes were damaged by a settling of the surface. James C. White, president of the company, is awaiting a decision from the State Mine Inspectors. John Conlon, president of the Conlon Coal Co., will pay for the rebuilding of Sacred Heart Church there after its damage by a cave-in work-

ings he controls. Mr. Conlon showed a generous spirit, as it virtually has been proved the cave was caused by mining conducted 20 years before he bought the coal tract. Residents of this town have refused the offer of the Madeira Coal Co. to repair 40 homes that were shaken and torn by settlings of the earth due to robbing of the coal pillars. They are in hopes of finding a law that will give them more than mere property damages.

Dickson City—Work started on May 1 by the Delaware, Lackawanna & Western R. R., Coal Department, in the excavation of ground a few feet west of the present Storr's breaker, for the erection of a new breaker. The breaker will not be an all concrete structure such as the one owned by the Lackawanna company at Taylor. However, when finished, it will contain the latest in breaker-building and will be one of the largest and best equipped in the anthracite region. It will be erected practically along the same lines as the wonderfully equipped Loomis breaker at Nanticoke, only the construction will be on a larger scale. Its capacity will be 4000 tons of coal per day.

Harrisburg—Approximately 2500 tons of river coal are taken from the Susquehanna River daily. There are 27 pumps working daily above the dam and about a score below. At least 50 tons can be drawn from the river bed daily by one pump. One of the largest fleets on the river is that of the Harrisburg Light and Power Co., including seven pumps, four steamers and fifty flats. Another operator has the contract to supply the state capitol building with its yearly supply.

Bituminous

Dubois—The large A. C. Hopkins coal holdings to the northwest of this city are about to be opened by the Hopkins Coal Co., some of the workings to be within city limits and beneath land already built over. The output will be hauled by way of the Harriger mine to the Hildrup tipple, or to a tipple to be built nearby, a two-mile tramroad being constructed up Slab run.

Indiana—The Two Lick Coal Co. has started the sinking of two shafts on the Ajax property, about 1½ miles from here. The new mines will be electrically equipped and will supply most of the commercial and local trade for Indiana. F. L. Neff is general manager of the new operations.

Punxsutawney—The Onondaga shaft just north of Punxsutawney and operated by the Buffalo & Susquehanna Coal and Coke Co. for some time, but abandoned by this company about ten years ago, has been leased to several capitalists of Buffalo, N. Y. They have begun to install new machinery, build houses, repair the tipple, power house, etc. The mine will be electrically equipped, and it is planned to start off with a production of about 600 tons per day. This will be increased until the production is 2000 tons per day, the requirements of the manufacturers who have charge of the property.

Savan—The Dormar Coal Co. of Indiana, has started work on the drifts, tramroad, incline plane, etc., on the tract of land known as the Hamilton farm. The tipple will be erected on the present siding, known as Leisure siding, on the Buffalo, Rochester & Pittsburgh Railroad.

West Lebanon—The stripping plant of the Corbett Coal Co. has begun to ship coal. The stripping of the overburden has been going on for the past year, and at the present time several acres of coal are ready to be loaded. The first day's shipments totaled 1000 tons. The shipments are made over the Buffalo, Rochester & Pittsburgh Ry., and the railroad cars are handled from the switch at the main tract to the operation over a switchback railroad by the company's private locomotive.

WEST VIRGINIA

Clarksburg—The Franklin Gas Coal Co. has begun shipping coal from its mine at Interstate, having recently opened a mine at that point.

Four different coal companies with as many openings are mining coal from a tract of only 12 acres, near Mt. Clare, in this county. The coal is hauled to the siding at Mt. Clare and shipped in box cars.

Former Sheriff Ross Stout is developing a 40-acre tract of coal near Mt. Clare, shipping about three cars a day.

Wayne—Having acquired 700 acres of coal land in Wayne County containing three excellent seams of coal, the Tri-Vein Coal Co. is opening a mine. As soon as a siding is completed it will begin the shipment of coal.

Fairmont—A ten million dollar byproduct plant is to be established here and the Fairmont Byproduct Corporation has been granted a charter for the purpose. The incorporators are O. F. Lough, C. E. Smith, E. B. Moore, F. B. Pryor and W. J. Wiegel, who represent the Monongahela Valley Traction Co. and the Greater Fairmont Investment Co., two important local interests of which Senator C. W. Watson is the dominant financial interest. Fairmont district coal will be turned into coke under this plan at Fairmont, which will materially relieve the railroad congestion. The plan contemplates the erection of 110 ovens at a cost of $50,000 each.

Fairmont—A new record was established at the Federal mine of the New England Fuel and Transportation Co. when in one day it hoisted 1206 mine wagons, representing 3800 tons of coal, or a tonnage sufficient to load 76 railroad cars.

Fayetteville—The Mill Creek Colliery Co.'s power house, which was washed out during the flood of March 13, is being rebuilt. New equipment has been ordered and a part of it is now on the ground.

ILLINOIS

Carlinville—Miners employed in sinking the three new mines of the Standard Oil Co. north of here are agitating the formation of a new local, in preference to joining the locals at Carlinville or Nilwood. They sent Michael Kelly, engineer at one of the mines, to see President Frank Farrington at Springfield about it. Farrington notified the State Board, which will make an investigation and probably grant the men at the new mines a charter, which will be the 301st in the state. It is expected that about 2700 men will be employed at the three mines.

O'Fallon—Work at Nigger Hollow mine No. 2 was halted one day this week while about 300 miners disciplined John Kupala, one of their number, for alleged disloyalty. Kupala has been earning $150 and $175 a month, but when asked to buy a Liberty Bond said that he had bought one. Some of the miners investigated and found that he had not. He was confronted and is alleged to have said something disloyal. He was permitted to go down, but later he was seized and taken to the top and tar and feathers were prepared. He fell on his knees and begged for mercy. A flag was brought and he kissed it. He was then permitted to leave.

Belleville—Fire believed to have been of incendiary origin recently destroyed the tipple and shaker house of the Little Oak mine, causing a loss estimated at $12,000 to $15,000. The fire started in the tipple and spread to the shaker house. There were large quantities of coal in both structures. The miners had departed 45 min. before the fire was discovered. The mine is owned by the Southern Coal, Coke and Mining Co. The 275 employees are thrown out of work. The mine was listed as 100 per cent. on third Liberty Bonds, but some of the miners bought with such manifest reluctance that they were threatened with a ducking. The State Fire Marshall has been asked to make an investigation.

Foreign News

Zurich—According to advices received from Vienna, the Austrian Minister of Railways recently announced the entire suspension of passenger traffic on the northern railways. This action was taken because of a shortage of coal, due to a strike of miners.

Brockville, Ont.—The St. Lawrence Coal and Freighting Co., Inc., was organized May 3 by the election of officers as follows: President, E. F. McCourt, Montreal; vice president, E. J. Burns, Ogdensburg; treasurer and managing director, J. A. Bresnahan, Brockville. The company will undertake to meet coal and freighting requirements at lake and river ports from Belleville to Cornwall, supplying a want which has for the past few years been a serious drawback to the coal trade.

Sydney, N. S.—Officials of the Dominion Coal Co. state that owing to the continued lack of shipping facilities it is quite improbable that much coal will be sent from Sydney up the St. Lawrence this season. The company finds it difficult to secure adequate vessel accommodation for the Maritime Province trade, and if coal is needed in any large quantities in Quebec or Montreal, purchasers will have to send their own ships to Sydney for cargo. This was done to some extent last year. Steamers will probably be sent by the Canadian Government Railways to bring coal to Levis, Que., to be distributed from that point.

Obituary

Carvin Pardee, Jr., general manager of Pardee Brothers & Co., Hazleton, Penn., widely known anthracite coal operators, died on May 13 from appendicitis.

Leo Miorelli, of Hazleton, Penn., 35 years old, national organizer of the United Mine Workers and member of the executive board of District No. 7, died after a long illness, on May 2. He worked for the miners' union in almost every state in the East and South.

Personals

C. E. Bockus, of Dante, Va., president of the Clinchfield Coal Corporation, has been elected a director of the National Coal Association, of Washington, D. C.

John Osborne, of Ashley, Penn., has been appointed outside foreman of the Maxwell No. 20 colliery of the Lehigh and Wilkes-Barre Coal Co., to fill the vacancy caused by the death of D. C. Tiffany.

Andrew K. Morris, superintendent of docks for the Erie Railroad Co., has been appointed director of tidewater coal traffic by the Anthracite Committee of the Fuel Administration and will have his offices at No. 50 Church St., New York City.

D. B. Wentz, of Philadelphia, Penn., president of the Stonega Coal and Coke Co., has been commissioned a lieutenant-colonel in the Quartermaster Corps of the Army. Colonel Wentz probably will be sent to France in the very near future.

Thomas Gambold, of Wilkes-Barre, Penn., who has been employed for a number of years as inside superintendent at the Stanton No. 7 colliery of the Lehigh and Wilkes-Barre Coal Co., has been promoted to the same position at Maxwell No. 20 colliery.

Charles O'Neill, formerly connected with the United Mine Workers of the central Pennsylvania District, and also the Fuel Administration, Washington, D. C., has been elected secretary of the Central Pennsylvania Coal Producers' Association, Altoona, Penn., recently formed.

C F. Taylor, who was a member of the engineering firm of Harrop, Hopkins & Taylor, of Pittsburgh, Penn., has retired to take charge of the coal stripping operations of the Kehota Mining Co., of Zanesville, Ohio. H. S. Harrop and N. F. Hopkins will continue the engineering business as Harrop & Hopkins.

Charles Philip Coleman, who has been vice president of the Worthington Pump and Machinery Corporation, of New York, since May, 1916, was recently elected to the presidency of the company. The corporation, aside from pumping machinery, manufactures mining machinery, air compressors, gas power engines and blowers, crushing and cement equipment and water works engines.

D. C. Botting, of Seattle, Wash., former state mine inspector and now secretary of the Coal Producers' Association and Commissioner for the Washington Coal Operators' Association, has been appointed district representative of the Federal Fuel Administration. Until the Federal Government assumed control of fuel Mr. Botting devoted most of his time to working problems that arose between the operators and their men. He was largely instrumental in negotiating for the wage increases that were granted miners in the State of Washington last year and in effecting the latest agreement, which became effective last November, by which the miners and operators fixed a wage scale which is to be binding for the duration of the war. One of his principal duties in his new work will be to speed up production of coal in the state.

Trade Catalogs

Blasting Caps and Electric Blasting Caps. Aetna Explosives Co., Inc., New York. Booklet. Pp. 12; 3¾x6 in.; illustrated. This little booklet contains in concrete form valuable information and data relative to the use of blasting caps. Precautions for the handling and storing of caps are given.

The Milburn Light. Alexander Milburn Co., Baltimore, Md. Catalog. Pp. 48; 6 x 9 in.; illustrated. An unusual feature of this well printed catalog is the embodying in the catalog itself of the complete directions for using the Milburn portable carbide lights. Several oxyacetylene torches and generating plants are also described.

Lower Pumping Costs with E-M Synchronous Motors—Electric Machinery Co., Minneapolis, Minn. Bulletin 183. Illustrated, 24 pp., 8½ x 11 in. The purpose of the bulletin is to demonstrate what the synchronous motor is now doing in the pumping field. Though not pretending to be an exhaustive analysis of the subject, anyone can gain from this bulletin an accurate idea as to the present status of centrifugal pump design and the duty required of the driving motors.

Coming Meetings

American Concrete Institute will hold its annual meeting June 24-26, at Atlantic City, N. J.

American Institute of Chemical Engineers will hold its summer meeting June 19-22 at Berlin, N. H.

Illinois Mining Institute will hold its next meeting May 23, 24 and 25, at Peoria, Ill. Secretary, Martin Bolt, Springfield, Ill.

Illinois and Wisconsin Retail Coal Dealers Association will hold its annual convention June 26 and 27, at Hotel Wisconsin, Milwaukee, Wis.

National Coal Jobbers Association will hold its annual convention at Buffalo, N. Y., June 4. Secretary, L. Romanski, Old Colony Building, Chicago, Ill.

American Institute of Electrical Engineers' annual convention June 26-28 at Atlantic City, N. J. Secretary, F. L. Hutchinson, 29 W. 39th St., New York City.

American Society of Mechanical Engineers will hold its spring meeting June 4-7 at Worcester, Mass. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Coal Association will hold a meeting May 28 and 29 at the Bellevue-Stratford, Philadelphia, Penn. Secretary, J. D. A. Morrow, 707 Southern Building, Washington, D. C.

Illinois and Wisconsin Retail Coal Dealers Association will hold its annual convention June 26 and 27, at Milwaukee, Wis., with headquarters at Hotel Wisconsin. Secretary. Isaac L. Runyon, Chicago, Ill.

National Retail Coal Merchants Association will hold its first meeting at Hotel Traymore, Atlantic City, N. J., Monday and Tuesday, May 20 and 21. Corresponding secretary, Jesse C. Suter, 1727 Pennsylvania Ave., N. W., Washington, D. C.

International Railway Fuel Association will hold a convention May 23 and 24, in Chicago, Ill., under the auspices of the United States Fuel Administration, and the United States Railway Administration. Secretary, J. G. Crawford, 702 E. 51st St., Chicago, Ill.

Industrial News

Charleston, W. Va.—The Dunlow Coal Co., of Williamson, Harry Scheer, president, has given notice of its intention to surrender its charter and discontinue business.

Philadelphia, Penn.—The Electric Service Supplies Co. annnounces that it has secured larger quarters for its New York office in the Hudson Terminal Building, 50 Church St., now occupying rooms 1771 and 1773.

Birmingham, Ala.—J. C. Maben, Jr., former vice president of the Sloss-Sheffield Steel and Iron Co., has announced that he will develop an extensive stripping operation in the Blue Creek field. Equipment is now being procured and placed.

Jersey City, N. J.—The Central Railroad of New Jersey, Communipaw Avenue, has contracted with the Robins Conveying Belt Co., 13 Park Row, New York, for the installation of a new belt conveying system at its coal pier No. 18, Jersey City.

Hazard, Ky.—The Industrial Engineering Corporation is the name of a new company that has been formed by R. L. Cornell, former general manager of the Kentucky River Power Co., to do all classes of electrical and mechanical consulting work and installation for the mining interests of this state.

New Lexington, Ohio—The Star Manufacturing Co., manufacturer of mine cars and mine-car equipment, is making a large addition to its plant, which will be ready for occupancy within 60 days. With its added facilities the Star company will be enabled to turn out 50 completed mine cars every day.

Wilmington, N. C.—The Cement Products Co., of Wilmington, N. C., manufacturer of the "Sanisep" portable sewerage disposal systems, announces the completion of its new electrically operated factory plant. This expansion of the manufacturing capacity is made necessary by the increased use of the "Sanisep" tanks in the coal towns as well as other industrial villages.

Altoona, Penn.—Substantial progress in furthering the organization of the new Central Pennsylvania Coal Producers' Association, which was launched at a meeting held in this city on April 24, was made at a meeting of the executive committee held here May 9, when Charles O'Neill was employed as general secretary and W. A. Jones as statistician, and John Lloyd, Jr., was elected permanent treasurer.

Russell, Ky.—Figures compiled here at the coal pool offices show that all records for movement of coal north have been broken since this coal pooling office was opened. The daily average number of loaded coal cars passing over the Chesapeake & Ohio during the first part of May was 1391 cars. The coal from the mines is shipped to Russell, from which point it is distributed in train loads, under the new Federal regulations.

Hazard, Ky.—The Electrical Supply and Repair Co. will begin at once the construction and installation of a large electrical repair shop and machine shop at this place. The concern, which is a new one, will also carry a large stock of electrical and mine supplies and equipments. L. B. Turnbull is president, and associated with him are R. L. Cornell and E. C. Carlin. It is understood that several well-known coal operators are financially interested in the new enterprise.

Fairmont, W. Va.—At a special meeting of the Central West Virginia Coal Operators' Association C. H. Jenkins, president of the district organization, was elected member of the executive committee for the West Virginia Coal Association, the state organization, the executive committee of which will organize at the Frederick Hotel at Huntington, June 1. At the same meeting J. H. Wheelwright and J. J. Tierney were named as directors of the National Coal Association.

Newport News, Va.—The Chesapeake & Ohio Railway Co., Richmond, is planning for the construction of a large new coal-storage plant at its local properties to have a storage capacity of 200,000 tons. The company has arranged for an extension to its trestle and trackage system to provide for an ultimate increase to 300,000 tons. Machinery for daily loading out to have a capacity for 6000 tons will be installed, this output to be ultimately increased to 12,000 tons.

Columbus, Ohio—Reports of loading at the Toledo docks during the week ending May 10 showed a large increase over the previous week. The Hocking Valley docks loaded 118,248 tons as compared with 85,810 tons the previous week. The total handled since the opening of the season is 250,150 tons. The Toledo & Ohio Central docks handled 47,000 tons as compared with 38,000 tons the previous week, making a total of 134,000 tons since the opening of the season.

Pittsburgh, Penn.—The E. J. Frauenheim Coal Co. calls attention to the fact that the item printed in the issue of May 11 relative to its operations reads as if the company was a recent organization about to start its development work. The E. J. Frauenheim Coal Co. has been organized for about one year, having already completed its two miles of railroad track. It is at the present time electrically equipped, the equipment being installed to handle 1000 tons of coal per day eventually.

Columbus, Ohio—An order has been issued at Washington changing the control of the Bureau of Coal Statistics, which has been operated in Columbus by all coal carrying railroads for more than 30 years. W. D. McKinney, a personal representative of the Federal Fuel Administration in southern Ohio, will be in charge. F. V. Davis, the present superintendent, will continue in that capacity. The bureau is regarded as one of the most valuable statistical collecting agencies in the Middle West, and a fight was required to keep it in operation.

Louisville, Ky.—Much interest has been shown by coal operators in the efforts of the Government to more evenly distribute labor through the opening of six Federal Labor Exchange Bureaus in Kentucky. One of these will be located at Fifth and Market Streets, Louisville; and others at Paducah, Henderson, Newport, Covington and Ashland. None of these offices are in the real coal districts, but several are not so very far removed. It is claimed that these bureaus will endeavor to prevent excesses in one place and shortages in others, and will work with the established bureaus and bureaus in other states.

Jefferson City, Mo.—The Missouri State Retail Coal Merchants' Association, at its first annual meeting here, indorsed the plan to pool all anthracite coal shipped into the state and have it distributed by the Missouri fuel administration. The opinion of the convention was that such pooling would result in each section of the state receiving its pro-rata supply, based on the business of 1916 and 1917. The following officers were elected: I. C. Knotts, St. Joseph, president; T. E. Williams, Springfield, vice president; E. J. Wallace, St. Louis, secretary and treasurer. Knotts and Wallace were elected delegates to the National Association, which will have its annual meeting May 21 at Atlantic City. Missouri Fuel Administrator Crossley and several prominent coal men delivered addresses.

Cincinnati, Ohio—The United States District Court has entered an order approving the contract entered into by John S. Jones, of Chicago, with the Hocking Valley Railway Co., for the purchase of $2,606,000 of bonds of the Sunday Creek Coal Co. at 25c. on the dollar, or about $626,531, thereby virtually holding that Jones now has valid title to the coal lands formerly owned by the Sunday Creek Co. in the Hocking Valley, about 25,000 acres. This is true because of the fact that the remainder of the company's $14,000,000 of outstanding bonds, held by several railroad companies, have been liquidated by the transfer of other properties covered by them. The Jones purchase was made as the result of an order of the court in 1914, requiring the railroad companies to dispose of all of their interests in the coal companies operating in the Kanawha and Hocking Valley fields. It is understood that large operations in the old Sunday Creek properties will now be pushed by Mr. Jones.

St. Louis, Mo.—Joseph W. Folk, general counsel of the Chamber of Commerce, has written to Attorney-General Gregory at Washington requesting that the Government institute contempt proceedings against the Terminal Railroad Association for violation of the United States District Court in enjoining the association from acting as an independent road between the east and west banks of the Mississippi River, and from making an arbitrary charge on traffic originating within the 100-mile zone that is not applied equally on traffic originating outside of the zone. The request is based on admissions in the answer of the Terminal association to the petition of the Chamber of Commerce to the Interstate Commerce Commission for the abolition of the arbitrary. These admissions are alleged to be that the Terminal association is an independent corporation and that the arbitrary of 20c. a ton on coal is imposed on shipments originating within the 100-mile zone and not on shipments originating outside of that zone.

Dallas, Tex.—C. W. Dawley, who owns much of the stock of the McAlester Coal Fields Co., of McAlester, Okla., is promoting a railroad to run from a point on the Rock Island near McAlester southeastward through a new coal field that is now being opened, and which promises to develop into one of the richest coal-mining sections of the state. The new railroad will leave the Rock Island between Dow and Bache, and will make use of what is now known as the Rock Island High Hill spur. The line will be of standard gage and its terminus will be about 3½ miles south of McAlester. Steel ties and other materials for its construction are now on hand and grading is going forward with all possible speed. Work of clearing away the overlying earth from the coal veins in the new field which will be tapped is now going forward, and it is desired to have the line completed and in operation before the winter sets in, as it is purposed to mine considerable coal and have it in storage for the early winter. Stripping operations will be carried on extensively in the new field, as the coal veins lie near the surface and the coal can be profitably mined with steam shovel.

MARKET DEPARTMENT

Weekly Review

Drive To Be Made for Coal Orders—Production Sufficient for Immediate Needs Only—Anthracite Restricted to Eastern Seaboard—Car Supply Still Factor in Bituminous Production—To Conserve Fuel in Power Plants—Lake Trade More Active

WE HAVE had Liberty Bond drives, Red Cross drives—and now there will be a drive for coal orders. During "Coal Week"—June 3 to 8—the Fuel Administration will redouble its already strenuous efforts to induce consumers to order their coal early. Thus the mines will be enabled to make immediate deliveries of all the coal that can be mined during the summer and to that extent help relieve transportation conditions next winter.

In the meantime coal production is barely keeping pace with the demand for fuel needed for immediate consumption. Some few plants here and there are accumulating reserve stocks, but a lack of sufficient storage space will prevent many from laying in much larger supplies.

Anthracite production is now at its maximum. The April shipments amounted to 6,368,372 tons, an increase of 776,074 tons over the corresponding month of 1917. Increased demands have absorbed the entire output, and no reserve stocks of any consequence remain in the hands of dealers. By order of the Director General of Railroads, shipments from the anthracite collieries to tidewater points are hereafter to be made up in solid trains, thereby doing away with the loss of time entailed by the unnecessary shifting of cars by the railroads. To further restrict the consumption of hard coal to those sections of the country where it is more urgently needed, no anthracite will be permitted to move west of the Mississippi River or into the South. The lifting of embargoes affecting New England, however, has resulted in the larger movement of much-needed coal to that quarter.

The steady increase in the production of bituminous coal recorded for three successive weeks suffered a setback during the week ending May 4, when 11,559,000 net tons were shipped. Telegraphic advices show that production for the week ending May 11 practically equals that of the week ending May 4. The greatest factor limiting production is the old one of inadequate car supply. Labor trouble in one Pennsylvania district further serves to diminish output, while in Alabama, where the car situation is fairly good, the miners refuse to work full time through inherent laziness more than anything else.

We still have with us the controversy regarding the price of railroad fuel. Owing to the illness of Mr. McAdoo this question remains unsettled. The railroads are buying coal on a hand-to-mouth basis and refuse to enter into contracts. The operator is thereby prevented from making contracts with other consumers, as the moment the situation clears the railroads will have the first call on the output of the mines. It can readily be seen that in the situation as it now exists there is no stimulus to production.

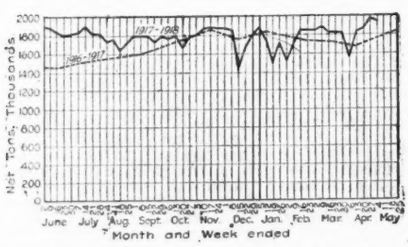
The necessity of keeping American industry going at high speed with the supply of coal that will be available this year has led to the inauguration by the Fuel Administration of a fuel-conservation movement in industrial power plants.

By the correction of firing and operating methods in industrial plants Dr. Garfield hopes to save at least 25,000,000 tons of coal. Each power plant is to be inspected by engineers appointed by the Fuel Administration. While no mention has been made to this effect, it is probable that plants with the lowest ratings will be the first to be cut off when there is not enough coal to go around.

The lake trade is becoming more active, as the ice is moving out of the upper lake passages rapidly. The vessel movement is better and considerable coal is now going to the Northwest. Coal-loading docks on Lake Erie are dumping an average of about 700,000 tons a week into lake freighters. The quantity loaded should amount to about 1,000,000 tons a week if the plans to supply the Northwest before next winter are to be realized.

COAL PRODUCTION

Bituminous output declined slightly during the week ended May 4, after three successive weeks of rising production. The total production of soft coal (including lignite and coal made into coke) is estimated on the basis of railway shipments at 11,559,000 net tons as compared with 11,803,000 net tons during the preceding week, or a decrease of 2 per cent. Production per working day is estimated at 1,927,000 net tons, considerably in excess of 1,829,000 net tons, the average during May, 1917. Production of beehive coke is estimated at 657,000 net tons, an average of 110,000 net tons per working day, as compared with 123,000 net tons during the preceding week. The decrease in production during the past week amounted to 11 per cent.



Byproduct Coke—The high standard of performance reported from byproduct operators last week was equalled and even exceeded during the week ended May 4. The ratio of production to maximum capacity rose from 89.1 per cent. the preceding week, to 89.6 per cent. Out of the 10.4 per cent. of maximum capacity which the operators of the country failed to realize in actual production, 3.7 per cent. was lost through lack of coal; 0.6 per cent. on account of labor trouble; 4.5 per cent. through repairs to plant; 0.3 per cent. because of "no market," and 1.3 per cent. for all other causes.

Operating conditions in the various states varied but little from the performance of the week before. Indiana reported the only material increase, the ratio of production to maximum capacity rising from 79.2 per cent. the week of Apr. 27 to 85.6 per cent. Increased supply of byproduct coal was the direct cause of the improvement. Kentucky was the only state to record a material decrease, the producing ratio declining from 90.3 per cent. the preceding week to 85.8 per cent. Repairs to plant was the cause given as limiting production. Pennsylvania, the largest producing state, is reporting the least favorable conditions and is now operating at 82 per cent. of capacity.

Beehive Coke—Shortage of yard labor limited production of beehive coke in the Connellsville and adjacent regions during the week ended May 4, causing a loss of potential capacity of 18.2 per cent. as compared with losses due to shortage of yard labor during the week ended Apr. 27 of 11.5 per cent. Sixty-three of the principal operators in the Connellsville, Greensburg and Latrobe Districts of Pennsylvania produced 324,100 net tons of coke, or 70.4 per cent. of their maximum capacity. Losses due to transportation conditions declined from 8.6 per cent. the week of Apr. 27 to 6.3 per cent. Mine disability was given as causing a loss of 3.6 per cent. The same operators produced 150,550 net tons of coal.

CARLOADS OF COAL AND COKE ORIGINATING ON PRINCIPAL COAL-CARRYING ROADS

	Week Ended			
	Apr. 13	Apr. 20	Apr. 27	May 4
Bituminous shipments, 123 roads	188,311	193,667	204,527*	202,351†
Anthracite shipments, 9 roads	37,760	39,130	39,522*	40,570†

* Revised from last report. † Subject to revision.

Anthracite shipments during the week ended May 4 rose to 40,570 cars, the largest since the week of Mar. 30.

BUSINESS OPINIONS

Bradstreet's—Improvement in weather conditions, crops, trade, especially at retail; industrial outputs, general rail and water transportation, and last, but not least, in stock market sentiment and dealings, constitute a sextet of favorable features in the week's reports. With the Third Liberty Loan largely overscribed, the business world seems to have turned its attention back to trade and industry, this process being, no doubt, facilitated by better weather, more optimistic crop reports and insistent government demand for all sorts of materials.

American Wool and Cotton Reporter—There has been no great change in the woolen goods market during the week under review, and the situation is likely to continue much the same until the very pressing need for Government fabrics is more fully supplied. The question of greatest importance at the present is in regard to the supply of goods which will be available for civilian purposes. In the first place, the Government has taken all the wool available, and is naturally making provision for the consumption of whatever raw material seems necessary to supply the goods needed. Until the total amount required is more definitely known it will be impossible to determine what the quantity of civilian production may be, or even the general character of such production.

Dry Goods Economist—The shortage of supply of raw materials shows no sign of improvement. In consequence manufacturers of various textiles find themselves unable to continue production of goods on order, or to undertake to make up new goods. Cotton prices are receding slowly on the New York Cotton Exchange. The changes, however, only affect the short staple which is suitable for the production of various heavy fabrics. Therefore, there has been no reduction in the cost of finished fabrics for household use or for women's wear. Cotton fabrics, like those of wool, are much needed by the Government and therefore production for ordinary commercial uses is far below normal. Under these conditions no downward revision of prices can be looked for.

Atlantic Seaboard

BOSTON

Cancellation of "Storrow order" discloses large number of industries unable to secure coal in sufficient volume for current needs. Unless receipts improve there are likely to be shutdowns even this summer. Anxiety increases over outlook as it is realized that "priority" will probably be necessary in order to get coal this fall. Assigned cars still being placed for railroad fuel. Undue demands being made upon central Pennsylvania. Efforts to increase movement via Hampton Roads meet with obstacles. Coal still in excess of bottoms at Southern piers. Textiles placed on preferred list. Baltimore & Ohio deliveries still disappointing, and movement on foot to exclude coals on that road from New England all-rail. Anthracite rail shipments somewhat improved, but receipts by water are meager. Fuel authorities encourage use of buckwheat and other steam sizes.

Bituminous—The large number of industries that were practically dependent upon the regular movement of "Storrow coal" all-rail has been brought prominently forward since the Garfield order of Jan. 3 was cancelled ten days or so ago. It was emergency coal, destinations in some cases being changed from day to day to meet urgent cases, and the lack of this tonnage will soon be keenly felt. It not only supplemented shipments through the usual channels all-rail, but it also helped out many plants that ordinarily rely wholly upon water receipts, but this season could not have been kept in operation without help all-rail. The coal coming forward under this arrangement never amounted to as much as 300 cars daily, although the original authorization was usually referred to as the "500-car order." The average for about 100 days was slightly in excess of 100 cars, including those furnished to certain of the railroads under the same terms, and the order therefore was only about 20 per cent. effective. The 20 per cent., however, was of great assistance, especially during January, February and March, in keeping important activities in operation.

The New England situation is decidedly serious. Tidewater receipts from the Virginia terminals are meeting the requirements of the very largest industries that for the most part are within 40 miles of rehandling piers, but so far there has been no opportunity to stock up. The important plants usually served all-rail are hard put to it to keep a fortnight's supply ahead. Coal is sought from every possible angle and frequently a big mill will draw supplies from three or four different discharging ports, paying differentials regardless of cost, and seeking to "borrow" railroad fuel to help out slim receipts all-rail.

Another feature of the present situation is the undue demand that is being made upon the central Pennsylvania district. Labor conditions there are none too good, chiefly owing to the high wages paid, and it is doubtful if output could be much increased even if better car-supply were forthcoming. The shortage of boats for Hampton Roads loading and the excess of boats over coal at the New York piers, together with the large differential in price in favor of Pennsylvania coals, are factors in the heavy demand. A considerable number of low volatile coals in this district have been practically segregated for bunker fuel to be furnished at New York, and the requirements at that port on account of traffic being sent there for oversea transport is in much greater proportion than in normal times. Connecticut points reached via New Haven are also eager to get Pennsylvania low volatiles, and so great is the pressure that the Fuel Administration at Washington has intervened to say that large tonnages for that area should be furnished from Hampton Roads. The difficulty there, however, is transportation, and there seems no ready solution.

Notwithstanding rulings of the fuel authorities assigned cars are still being placed for engine fuel. Certain mines west of Altoona, Penn., were furnished no other equipment a week ago, and there are whole groups of mines where for weeks at a time there is no commercial coal available. Until railroad fuel is definitely adjusted and some working basis is devised there are bound to be inequalities in distribution.

At Hampton Roads there continues more coal on hand than there are steamers and barges to take it away. Shippers are casting longing looks in the direction of the Lakes, where 3000-ton steamers are beginning to start through the canals for coastwise service. A number of these boats are scheduled to load Dominion coal at Cape Breton for different New England ports in the effort not to waste transportation or to leave out any move that will secure coal for our industries. The latter are responding gladly, and it is certain that the 100,000 tons in view from this source will be readily absorbed.

Operations on the Baltimore & Ohio R.R. continue to be seriously hampered by poor car supply, although the past week there has been a slight improvement. A new difficulty faces consumers here who rely upon tonnage from that quarter, for this week there have been wholesale diversions to tidewater piers such as those at Curtis Bay and Port Covington of coal destined all-rail into New England. It has been customary for these coals to be confined rather rigidly to points on the New Haven road, but if from industries on this line this supply is to be thrown to tidewater on the assumption that boats will be forthcoming to move it a very serious mistake will be made. If the important plants of Connecticut are to be excluded from the Myersdale and Fairmont region as well as from central Pennsylvania they will be orphans in fact.

Anthracite—There is practically no change in the movement of anthracite, except for somewhat better volume all-rail now that the gateways are all open. Water shipments are still very low and sizes are not well assorted. Points along the Maine coast are being favored on account of the ruling of the distributing committee. It is an interesting fact that the first 10 days in May 31 per cent. of the total anthracite moving into New England was culm and steam sizes. The local fuel authorities are strongly encouraging the use of these coals to supplement bituminous in view of the shortage of bituminous that is certain to prevail next season.

NEW YORK

Anthracite market continues to be active with no let-up in demand. Dumpings at the local docks indicate larger shipments, but much of it goes to New England. Local retail dealers have plenty of orders to keep them busy for months to come. The bituminous situation serious, with bunker coals in good demand.

Anthracite—The situation continues to be active. Reports show comparatively little increase in receipts, while the coal goes direct from the dock to the consumer's cellar. As has been the case for some time, many yards are without coal, and this condition is not confined alone to the small dealer but involves some of the yards of the larger dealers as well. There is a persistent effort on the part of every consumer to get his winter fuel in his cellar, and he is being urged on by frequent statements from Fuel Administration officials, which in the opinion of some dealers are at this time unnecessary in the face of existing conditions. Local dealers are well supplied with orders, sufficient in most cases to keep them busy for some months, even though they received no more.

Conferences have been held during the past week between representatives of the Federal Fuel Administration, including Dr. Garfield, and the local forces regarding the situation, with particular reference to the desires of the city officials to store at least 300,000 tons of coal to be sold to the poor during the next winter. The chief obstacles in the eyes of those responsible for the carrying out of the plan, outside of securing the coal, is a place or places where the coal can be stored and then the work of distribution next winter.

Nearly a thousand cars more of anthracite were shipped to market during the week ended May 4, according to reports, than were shipped during the previous week, while the dumpings at the New York tidewater docks for the nine days ended May 12 were 8875 cars as compared with 7303 for the seven days ended May 4, an increase of 1572 cars. While these statistics indicate a large increase in dumpings, it must be remembered that considerable of this coal was for shipment by water to Eastern points, the amount of domestic sizes available for New York trade remaining only moderate.

The arrangement by which a part of the output of certain companies is to be sent direct to the local tidewater docks and nearby storage grounds ought to alleviate conditions.

The steam coal situation is easier. Buckwheat No. 1 continues in good demand, but rice and barley are such that some is being stored by large consumers.

The President of the Borough of Manhattan will open bids on May 20 for 7500 tons of buckwheat No. 1 and 36,000 tons of buckwheat No. 2, besides large tonnages of the other sizes.

The Board of Education will buy $65,000 worth of coal in the open market because of the nonreceipt of bids for furnishing the schools in Brooklyn, Queens and Richmond with fuel next winter.

Current quotations, per gross ton, f.o.b., tidewater, at the lower ports are as follows:

	Circular	Individual
Broken	$6.15	$6.90
Egg	6.05	6.80
Stove	6.30	7.05
Chestnut	6.40	7.15
Pea	4.90	5.65
Buck	4.45@5.15	4.80@5.50
Rice	3.90@4.10	3.80@4.50
Barley	3.40@3.65	3.00@4.00
Boiler	3.65@3.90	.....

Bituminous—There has been little if any improvement in the local situation. Demand continues heavy with no coal to meet it, and shippers are unable to meet the calls made upon them; consequently there is comparatively no coal being stored in anticipation of next winter's needs.

Production for the week ended May 4, according to reports, was not so heavy as during the previous week, a decrease of 2 per cent. being noted, while at the New York tidewater docks 7810 cars were dumped during the interval between May 4 and May 13 inclusive.

Conferences have been held during the week which were participated in by representatives of the Railroad and Fuel Administrations and the Shipping Board, looking toward improvements in the situation, with particular references to shipping.

The question of pooling the boats in the harbor is again attracting much attention and is looked upon favorably by most shippers. Much complaint is heard regarding the holding up of boats for several days at the docks, meantime the demurrage charges are piling up and taking away whatever profits there might have been in the sale of the coal.

There has been practically no change in the car situation, but operators and shippers are hopeful and with higher temperatures due look for much better conditions.

New England buyers continue to urge shipments.

Bunker fuel is in good demand and complaint has been heard of some slight delay in sailings, because of its shortage.

BITUMINOUS PRICES

	F.o.b. New York Gross	Mine Price Net	Gross
Central Pennsylvania	$5.06	$3.05	$3.41
Maryland:			
Mine-run	4.84	2.85	3.19
Prepared	5.06	3.05	3.41
Screenings	4.50	2.55	2.85

PHILADELPHIA

Anthracite shipments unsatisfactory. Some hope of early improvement. Retailers fear labor shortage. Some complaint of preparation. Buckwheat order ignored by some. Storing of steam coals. All sizes fully taken, with some easiness in rice. Bituminous shipments do not increase. Small tonnage equitably distributed. Labor unrest again.

Anthracite—With slow shipments and slower deliveries by the railroads, conditions cannot be said to have improved. There is little coal in the dealers' yards, but this would be the case even if shipments had been heavier. It is just possible the dealers are more optimistic than last month, as they are beginning to believe they will receive much heavier shipments during the summer months. In normal times there is practically no family business during July, August and early September. This year, if the shipments are as substantial as the dealers are led to believe they will be, they will undoubtedly make heavy inroads on the large volume of business now on their books. It will mean an unusual summer for both men and teams, and at this time we hear as much fear expressed over the scarcity of labor as of coal. Many dealers have quietly increased the wages of their delivery forces, yet many of the men continue to be weaned away by the fancy prices being paid at the immense war plants hereabouts for the most ordinary labor.

Shippers of coal have been advised of the general embargo on carload freight which became effective on the 15th. While it is too early to note definite results, it is felt that it will do much toward relieving congestion on the railroads and hasten coal deliveries.

While the dealers continue to read about the greatly improved preparation of the coal they are to receive, due to Federal supervision, it is a fact that considerable undersize coal is coming to this market. Possibly the most general complaint is the percentage of pea in the chestnut. Dealers who refrained from even calling the shippers' attention to inferior coal during the great scarcity of the past winter say that when they were doling out their coal in lots of one ton or even a less quantity this matter of preparation was not so important. Now, however, they state their trade are inclined to be critical and are objecting to having their cellars filled with poor coal.

The shipping companies have received a notice clarifying the situation as to shipments to Canada. The National Administration stated that while the permits which had been issued specified the quantity, this was only to be construed to mean the maximum tonnage that they will be permitted to ship under any circumstances, and is not to be considered as an order; but that the distribution is to be controlled by the Administration as it may see fit, by instructions issued from time to time.

In the steam trade all sizes continue to be quickly absorbed, and while all the tonnage is not going for immediate consumption, yet even this is much heavier than last year. We notice that big consumers of steam sizes are receiving quite a little tonnage in excess of their current requirements and are stocking the coal in various open spaces throughout the city. This applies particularly to concerns such as department stores, etc., who formerly had not been accustomed to laying in reserve stocks. If there is one steam size easier than any other it is rice, and a few cars of this size are often obtainable by a new consumer, especially from the larger companies, who are operating big washery operations at this time.

The prices per gross ton f.o.b. cars for line shipments and f.o.b. Port Richmond for tide are as follows:

	Line	Tide		Line	Tide
Broken	$4.90	$6.05	Buckwheat	$3.15	$3.75
Egg	4.50	5.70	Rice	2.65	3.65
Stove	4.75	6.05	Boiler	2.45	3.55
Nut	4.85	6.10	Barley	2.15	2.40
Pea	3.45	4.35			

Bituminous—There has been no increase in the tonnage of bituminous coal received in this city. Rail congestion and car shortage continue to hold back production and little, if any, improvement has been shown recently. Your correspondent interviewed a prominent shipper this week who gives it as his opinion that a great proportion of the congestion is caused by the consignment of the enormous quantity of general freight to New York harbor piers for loading. The claim is made that the pier and loading facilities of other ports are not utilized to their utmost, due to the fact that in ordinary times railroads have discriminated in favor of the above-named port.

While the coal supply in the city has continued short, yet we do not hear of the closing down of plants as was common a short time since. There is no doubt that this is due to the equitable manner in which such coal as does reach here is distributed by the committee of coal men who have been working with the fuel committee for some months past. They have now got the plan in such a shape that they are prepared to meet almost any emergency. Of course, no one is able to accumulate a surplus under this arrangement, but the committee is able to see that every plant is receiving a proportion of coal coming into this market.

With the strike in the Huntingdon and Broad Top region the question of wages among the miners is once more coming to the fore. The present difficulty was caused by the fact that up to April the operators in that region had voluntarily been paying the men a bonus of 10c. a ton. However, the Federal authorities have ruled out this provision as a discrimination and as a consequence the men are asking for increased pay. The movement is spreading to other regions, although no definite steps have been taken by the men requesting an increase.

In the exclusively brokerage trade the houses still appear to be able to secure a limited amount of coal, and it is believed that a very large proportion of this is procured by direct solicitation in the region from the small mines, as much of the coal comes here loaded in box cars.

BALTIMORE

Supply of soft coal here better under the zoning plan, but cause seems a little irregular. Plan to have a hard coal order week interests trade.

Bituminous—There can be no doubt that the supply of bituminous coal here is at present considerably better than for some time past. In a general way the officials of the fuel administration and coal men aiding in the fuel distribution work are attributing it to the operation of the zone plan. The particular situation here, however, has had a rather odd influence in the fact that it is reported that large quantities of soft coal which reached the redesignating points in the Cumberland gateway were diverted here because they had originally been loaded for New England points under the zone ban. This influx of coal here, combined with some little that came through under direct consignment, was sufficient to give all the piers and line terminal points in this vicinity a busy week. A large quantity of fuel was handled for the Shipping Board, and the extra handling caused the Government to operate the Locust Point pier to such an extent as to practically preëmpt it for the week. This pier of the Baltimore & Ohio is usually the local harbor distribution point because of the fact that when the Western Maryland at Port Covington, or the Baltimore & Ohio pier at Curtis Bay, is used there is a considerable extra towage charge. No one seems to kick at extra charges just now when coal is badly needed, however, and the influx of fuel was readily cared for. While there is some ease-up in railroad congestion between this city and the mines, conditions are still far from satisfactory and much more coal could readily be absorbed here.

Anthracite—There is general interest here in the project to have a week set aside for the placing of domestic orders for hard coal. A good proportion of the business is already on the books, as a result of urging by the Fuel Administration, much more indeed than there is any possibility of covering even by two-thirds delivery before the end of June, but the effort to have practically all orders put on the books before midsummer is nevertheless generally approved. Even if it is not delivered before the fall it will give a line on what the coal men here will need in greatest bulk. Meanwhile deliveries here continue light.

Lake Markets

PITTSBURGH

Car supplies still far below requirements. Steel mills disposed to stock coal.

Car supplies at Pittsburgh district mines are showing but slight improvement, at long range, and from week to week there is but little perceptible difference. The general testimony is that supplies are quite insufficient for capacity production of coal in the district, and also quite insufficient to give all consumers the amount of coal they would readily take. The current needs of consumers are being well taken care of, but there is little excess for stocking purposes. While domestic consumers may need considerable urging on the part of the Fuel Administration to lay in stocks this spring against next winter's requirements, the steel industry requires no urging, but is anxious to accumulate stocks for power purposes, gas production and byproduct coking. Especial attention is being given to gas coal, for the mills had some particularly trying experiences last winter, when it was difficult to secure absolutely needed gas coal, the authorities apparently being unable in all cases to grasp the distinction between gas and steam coal. The Government steel inspectors, however, did not relax their diligence, and some mills had a hard time trying to use high sulphur coal for gas production at openhearth furnaces and still keeping the sulphur in the steel down to the requirements of the specifications for Government steel.

Occasionally there is coal to be had through brokers, who are fairly busy doing a maximum amount of work on a minimum amount of tonnage, as transactions are put through with much more difficulty than formerly. The market remains quotable at the set prices: Slack, $2.20; mine-run, $2.45; screened, $2.70, per net ton at mine, Pittsburgh district, with an extra allowance of 15c. which brokers are allowed to charge.

TORONTO

Coal situation unchanged. Dealers overwhelmed with orders which they cannot fill. Receipts light. Wood to be largely used as substitute for coal.

The coal situation remains practically unchanged. Owing to the determination of consumers to lay in their supplies for next winter early, the dealers are overwhelmed with orders which cannot possibly be filled for some time. Deliveries are generally confined to small lots sufficient to meet present requirements. Receipts by rail continue light owing to the quantities being shipped by water to western points. The question of providing substitute fuels is receiving much attention. The provincial Department of Lands, Forests and Mines is letting contracts for cutting 25,000 cords of hardwood in Algonquin Park for the supply of public institutions, and several cities are arranging for supplies from the same source.

Quotations per short ton for best grades are as follows: Retail anthracite egg, stove, nut and grate, $10; pea, $9; bituminous steam, $8.50; slack, $7.50; domestic lump, $10; cannel, $13. Wholesale f.o.b. cars at destination three-quarter lump, unprepared, $6.11; prepared, $6.31; slack, $5.18.

BUFFALO

State of coal trade not much changed. Dealers find bituminous hard to get, but the demand is rather light. The opinion continues that present conditions give no chance to jobbers. Heavy demand for anthracite.

Bituminous—The supply is light, but the demand is not heavy as the consumers do not generally follow the plan of the consumers of anthracite in insisting on stocking up all they can get. It is reported that the railroads have gone into the market more largely within the past few days, and if that demand continues it will take care of any surplus coal that may be on the market. Buffalo is well supplied, but there is no coal waiting on track. The situation here is easy all around, though the future of the jobber is still in doubt. Few if any of them are doing a normal business.

The reports of congestion in Canada continue, though it appears that shipments there will hold up awhile, at least till the coal on demurrage is sold. Much money has been lost by the effort to secure the seller's margin of 30c. a ton which is allowed there instead of the 15c. here. Quite a good many Buffalo jobbers have set up a Canadian office, mostly in Toronto, where the effort was to meet the demand on a basis that promised a little profit, but it was soon so badly overdone that it is doubtful if much advantage was gained.

The Allegheny Valley price of $4.45 for all sizes has not made coal plenty there, all reports agreeing that it is still scarce. Pittsburgh prices remain at $4.25 for lump, $4 for mine-run and $3.75 for slack, all per net ton, f.o.b. Buffalo.

Anthracite—The local supply keeps up at about par with former seasons, though it is of course far short of the demand, which would cover the entire year's needs if it could be done. No consumer is at all satisfied with the normal amount, and but for the regulation forbidding the distribution in any but a horizontal way, the coal would soon be a cellarful here and nothing there. Outside shipments, especially to Canada, are taken care of by the shippers

in the same way. They see the impossibility of preventing suffering in secluded districts, unless the supply now going out is divided so that nobody gets more than a just proportion.

The lake trade is not very active yet, but the heaviest shipper has not loaded anything so far, though preparing to do so now. For the week the amount was 67,850 net tons, of which 27,100 tons cleared for Duluth and Superior, 19,400 tons for Milwaukee, 8000 tons for Sheboygan, 7300 tons for Green Bay, 3050 for Lake Linden and 3000 tons for Hubbell.

Rates are unchanged at 55c. for Milwaukee, 50c. for Sheboygan and Green Bay, 48c. for Duluth and 45c. for Lake Linden and Hubbell.

DETROIT

Receipts of bituminous and anthracite continue below normal. Detroit Board of Commerce investigates margin controversy.

Bituminous—While Federal and state fuel administrators are supporting the campaign to induce consumers of steam and domestic coal to buy now, in providing for their next winter's requirements, the movement of bituminous coal into Detroit continues to fall short of shipments in preceding years at this time. The amount of coal received at present, according to some of the jobbers, is considerably less than should be coming to Detroit to provide for current requirements.

The supply of slack seems less plentiful than would be desirable, though it is expected the loading of lake coal will improve the situation shortly. The diminished volume of receipts is attributed largely to the deficiency in supply of railroad equipment for its transportation. The shortage of cars, which has been a troublesome factor in the market for months, has been made more pronounced by the needs of lake shippers, which has resulted in diversion of cars and motive power to facilitate and expedite movement of coal from mines to loading docks.

Detroit Board of Commerce has been probing merits of the controversy between W. K. Prudden, Michigan fuel administrator, and Detroit coal dealers in reference to the fuel administrator's insistence that a $2.50 margin is adequate for the dealers for delivery of domestic coal during the summer months.

Anthracite—Few of the Detroit retailers have anthracite in stock and in none of the yards is there any substantial amount. With household consumers clamoring to have orders for next winter's supply filled, the dealers are, in many instances, refusing to accept orders for hard coal, owing to uncertainty as to what supply they will obtain and when it will be provided.

Lake Trade—Coal loading docks on Lake Erie are dumping into lake freighters an average of about 700,000 tons a week. It is calculated that the quantity loaded should amount to about 1,000,000 tons a week, if plans of the shippers for supplying the Northwest before the coming of freezing weather, are to be realized. The supply of tonnage offered for loading exceeds the cargoes. So far the movement of iron ore is light and freighters wait to load coal which, because of shortage of cars, is slow in arriving at the docks.

COLUMBUS

Better production of all sizes is reported from Ohio mining districts. Lake trade is increasing in activity, and domestic and steam demand remains brisk.

The Ohio coal trade has showed rather remarkable activity during the past week. According to reports from various districts the output has been increased to a more hopeful figure. Car supply is now better in all mining districts, and on the whole the outlook is rather cheerful. Demand for steam and domestic sizes remains strong, and strenuous efforts are being made to supply the domestic demand in order to avoid a repetition of the stress of last winter.

Retailers are busy making deliveries to householders, who are heeding the frequent warnings sent out by the Federal and State Fuel Administration officials. Hocking and Pomeroy grades are the principal varieties in the local market, although some Pocahontas and West Virginia splints are arriving. Consumers who have been waiting for the fancy grades are now buying Ohio coal more freely than formerly. A considerable tonnage of Pocahontas was received recently and this was quickly disposed of. Retail prices are firm at former levels. Anthracite is quite scarce and is selling between $11 and $12. Domestic coke is also higher.

Steam business is more active as large consumers are again in the market with orders intended for stocking purposes. The smaller steam users are buying for immediate needs only, as they believe that their requirements can be taken care of by the surplus over lake requirements.

Production in Ohio fields has been much better and a better feeling is shown in operating circles. Eastern Ohio, which has been lagging behind because of lack of cars, is now producing a considerable tonnage, estimated at 80 per cent. of capacity car ratings. The Hocking Valley is producing close to 90 per cent. and the same is true of Pomeroy Bend. Other fields are rather active.

Lake trade is becoming more active as the ice is now moving out of the upper lake passages rapidly. The vessel movement is better and considerable coal is now going to the Northwest. All of the lower lake docks have been busy loading bottoms. Docks in the Northwest are in good shape and little is being carried over from last season with the exception of mine-run and slack. Many permits have been issued by the Ore & Coal Exchange for the shipment of Ohio and West Virginia varieties.

CINCINNATI

Improving receipts, both by rail and river, and mild weather, have encouraged the trade. Deliveries on orders for current consumption and storage are progressing well.

While the car situation is not yet all that could be desired, judging by reports from both West Virginia and eastern Kentucky, the situation has still shown enough improvement, measured by actual receipts of coal on this market, to furnish much encouragement to the trade and to enable better deliveries to be made to customers. If receipts by local dealers will permit, it seems probable that the entire winter's supply of most domestic consumers, as well as of many large industrial consumers, will be in storage by the end of the summer season, which will be an absolutely unprecedented state of affairs. The favorable stage of the river is permitting arrangements for large shipments by that route to proceed, and river companies are taking advantage of the fact to fill their bins from their barges and thence deliver coal as rapidly as possible to customers. Nothing whatever is heard in the way of price discussion now, as consumers are aware of the fact that Government figures are the only ones to be had, and anxiety to secure adequate supplies of fuel overtops all other consideration. The situation is an ideal one for the trade, from almost every standpoint.

LOUISVILLE

Steam demand a little draggy, with domestic sizes in good demand. Excellent demand for gas coal and coal for by-products plants. Car supply improving.

In summing up the situation in Kentucky it is found that there has been an active demand for domestic and byproduct coal, but that steam has been a bit dull. However, business is active as a whole and operators are not making any effort to accept more than about 5 per cent. of the new business that is now being offered, as many have contracted up in fair shape. In western Kentucky there has been a more active demand for steam coal than in eastern Kentucky.

The car situation has shown some improvement in eastern Kentucky, where about 60 per cent. of requirements is now being had. In western Kentucky about 45 or 50 per cent. of the needed supply is being received. There are inequalities in distribution, but that apparently can not be helped at this time. Much labor has gone to the farms, and the mines as a whole are probably held back about 10 per cent. on account of the labor shortage.

No anthracite is on the market, and Kentucky is now on the anthracite barred list. Coke is also scarce and hard to obtain, although numerous metal-working plants are securing supplies by going into West Virginia for requirements.

BIRMINGHAM

Domestic consumers are now buying steadily and much coal is being stored for winter use. Priority regulations made more stringent. Both domestic and steam supply continue far short of requirements. Production hindered by irregular work.

Consumers of domestic coal have at last more fully awakened to the necessity of laying in coal for the approaching winter. Local yards are unable to handle the orders tendered, and their stocks are kept almost depleted by current demand. This is one encouraging feature in the face of the apparent inability of retailers to accumulate coal on their yards; they are selling it as fast as it comes in, and therefore it will not be necessary to accumulate the large stocks heretofore made available for the fall and winter demand. Another evidence of the activity on the part of the householders to provide against any possible future shortage is the large number of permits being issued by the fuel board for carlots to be prorated among community consumers. Dealers are able to make but few contracts with the mines and therefore cannot promise definite deliveries to their customers.

The situation in the steam trade has been intensified further by instructions from the Fuel Administrator that any surplus over and above the full requirements taken by essential or priority consumers must be held subject to disposition as directed by the Government authorities. It would seem that this regulation will result in the gradual elimination of all nonessential industries from participation in the coal supply. The Southern Ry. during the past week took 47 per cent. of the output of the mines on its lines, which is an exceedingly heavy drain on the supply.

Production is heavy, but the tonnage taken out is not at all commensurate with the task that should be rightfully expected from the forces employed at the operations, and indifference and inefficiency are given as the prime factors responsible for this situation.

Coke

CONNELLSVILLE

Coke shipments increase slowly. Pig iron production increases more rapidly. By-product plants will help.

Car supplies in the Connellsville region continue to increase from week to week, on an average, but the increase is slow and the distribution through the week is quite irregular, works receiving more cars some days than they can load, and not nearly enough on other days. Such increase in car supplies as has occurred in the past three or four weeks has been due wholly to coke moving through more rapidly, and empty cars also getting better dispatch, so that the time of the round trip is reduced.

The slight increase in coke shipments has been attended by a proportionately greater increase in the production of pig iron, that being due to the furnaces now working to good advantage, while in the early part of the year the consumption of coke, per ton of pig iron produced, was very high, owing to irregular working, frequent bankings and poor quality of some of the coke, due to its having been held in ovens too long, awaiting cars. Pig-iron production in the country as a whole is now at the rate of over 41,000,000 tons a year, while late in January and early in February it was down to below a 30,000,000 rate. The Carnegie Steel Co. is operating 53 of its 59 blast furnaces, which is very nearly normal. It was down to 29 furnaces for a few days early in the year.

When the Clairton, Cleveland, Lorain and Ironton byproduct plants are running full, within a very few months, there should certainly be an ample supply of coke. The first three are Steel Corporation plants, Ironton being a merchant proposition, which has been making ten-year contracts with blast furnaces in the district.

Very little Connellsville coke is finding its way to the open market, shipments being readily absorbed by contracts. Some of these are at flat prices, averaging about $8.25, while some are based on the prevailing market and thus are settled at the Government price. The market remains quotable at the Government limits: Furnace, $6; foundry, 72-hour selected, $7; crushed, over 1-in., $7.30, per net ton at ovens.

The "Courier" reports production in the Connellsville and lower Connellsville region in the week ended May 3 at 333,455 tons, a decrease of 10,410 tons. Returns of rail shipments are temporarily interrupted. River shipments are given at 16,120 tons, against 17,620 tons the week preceding.

Buffalo—The movement of coke is light. Jobbers get no business as between the ovens and the furnaces, as there is no margin for them, so the furnaces buy of the ovens direct. The local byproduct coke plants are selling quite an amount of their surplus, partly at least through the jobbers, which competes with the regular bee-

hive coke. A considerable amount of fine "breeze" coke is also selling to steam plants, being obliged to compete with the small sizes of anthracite in that trade.

Birmingham—There is no change to be noted in the local coke market. Strong inquiry continues, but the supply of both furnace and foundry coke is short for the spot trade. Production is fair but not up to normal capacity. The supply of both rack and box equipment is satisfactory, and delayed deliveries are being caught up with rapidly.

Middle Western

GENERAL REVIEW

Size coal demand continues to be firm. Screenings and washed No. 5 moving slowly.

Well-prepared size coal is in unusually good demand throughout the Middle West. In fact in most all sections there is a struggle by the operators to come within gunshot of being able to produce anything like enough to supply their customers. Sections of the country that will be outside the zone limit after Nov. 1 have made, and are now endeavoring to get, a year's supply within the time limit. Former claims that they could not store coal seem to have been swept aside, and unusual activity is apparent. During the past week several large buyers from Minneapolis and St. Paul, Minn., have visited mining fields in their endeavor to pick up any loose coal. Fine coal has been soft the latter part of the week. However, little alarm is noticed, and the general feeling is that a better market is near for screenings and No. 5.

Labor conditions are still bad, and railroad equipment is short. Never in the history of some of the oldest mine men has there been so much grip and pneumonia as has prevailed throughout the coal field during the past month, and coal miners seem to have been special victims. Quite a number of deaths have been recorded. Coal-car equipment continues to be distressingly short in many localities, but as a whole transportation conditions show an improvement over corresponding weeks last year.

MILWAUKEE

Coal matters exceedingly quiet. Orders for future delivery coming in slowly. Organized effort to stimulate this phase of the coal problem.

Matters in the coal line are exceedingly quiet at present. Raw spring weather keeps dealers busy delivering small lots to piece out the waning season, but orders for next winter's supply are not coming in as freely as the coal administrators desire. It will follow psychologically, however, that when fires are out for good and bins are empty there will be a deluge of urgent calls. It would help matters in this respect if the summer schedule of prices were promulgated.

Interest just now centers in the coming supply. Since last week's report 12 cargoes aggregating 97,366 tons have reached port. Of this amount 20,366 tons were hard coal. The receipts for May, thus far, total 228,083 tons, of which 47,602 tons were hard coal.

Gov. E. L. Philipp, State Fuel Administrator W. N. Fitzgerald and Mayor D. W. Hoan have been in conference regarding the coal supply for next winter, and as a result there will be a meeting of representatives of the heavy coal-consuming counties of the state in the near future. Leading coal handlers will be invited to attend and discuss the matter from their viewpoint. Letters will also be sent to every business concern in the state urging them to get in their coal orders as soon as possible. It is believed that enough wood has been cut to run the creameries and dairies of the state during the coming winter.

Kenosha, Wis., has appropriated $20,000 for the establishment of a municipal coal yard. It is expected that 45,000 tons will be handled during the coal-burning season. William Rahr, Jr., has been named fuel administrator of Manitowoc County.

CHICAGO

Domestic demands continue to grow. Screenings easy.

The Chicago market has not shown any marked changes within the past week. The domestic demand has been growing and the steam demand is about stationary, as is also the car situation. The efforts of the Cook County fuel administrator to start a storage movement in many of the industries gave the steam demand quite an impetus, and has had a helpful influence. The anthracite situation is not as encouraging as it might be, the large companies that were able to get considerable coal last year at this time, having to content themselves with a much reduced tonnage, delivered in small lots, with a promise that more will be available later in the season. Retail dealers are not accepting orders for hard coal, simply noting them with the hope that their supply will be increased prior to the winter season. The ultimate users to some extent do not feel warranted in allowing their orders to stand and are willingly accepting anything they can get, whether it be anthracite or bituminous.

Because of the free movement of size coal, some of the larger users of screenings have thought that they would be able to break the screenings market and have put considerable pressure in this direction by refusing to buy, claiming they were loaded, when really they should have been absorbing all that was offered. No headway was made, and many of those that refused to buy two weeks ago are now in the market.

Quotations in the Chicago market are as follows, per net ton f. o. b. cars at mines:

	Williamson and Franklin County	Mt. Olive and Staunton	Standard
6-in. lump..	$2.65@3.00	$2.65@2.80	$2.65@2.80
3x6-in. egg.	2.65@3.00	2.65@2.80	2.65@2.80
2x3-in. nut.	2.65@3.00	2.65@2.80	2.65@2.80
No. 2 nut..	2.65@3.00	2.65@2.80	2.65@2.80
No. 3 nut..	2.65@3.00	2.65@2.80	2.65@2.80
No. 4 nut..	2.65@3.00	2.65@2.80	2.65@2.80
No. 5 nut..	2.15@2.40	2.15@2.40	2.15@2.40
2-in. scrgs...	2.15@2.40	2.15@2.40	2.15@2.40
2-in. lump..	.....	.....	2.25@2.50
3-in. lump..	.....	2.50@2.65	.....
Steam egg..	.....	2.35@2.50	2.25@2.40
Mine run...	2.45@2.60	2.45@2.60	2.45@2.60
Washed:			
No. 1.....	2.65@3.00	2.65@3.00	2.65@3.00
No. 2.....	2.65@3.00	2.65@3.00	2.65@3.00
No. 3.....	2.65@3.00	2.65@3.00	2.65@3.00
No. 4.....	2.65@3.00	2.65@3.00	2.65@3.00
No. 5.....	2.15@2.30	2.15@2.30	2.15@2.30

	Williamson and Franklin	Saline and Harrisburg	Fulton and Peoria	Springfield	Carterville	Grundy, La Salle, Bureau and Will
Steam lump.....	$2.65@2.80	$2.65@2.80	$3.05@3.20	$2.65@2.80	$2.65@2.80	$3.35@3.50
Domestic lump.....	2.65@3.00	2.65@3.00	3.05@3.20	2.65@3.00	2.65@3.00	3.35@3.50
Egg or furnace.....	2.65@3.00	2.65@3.00	3.05@3.20	2.65@3.00	2.65@3.00	3.35@3.50
Small egg or nut.....	2.65@3.00	2.65@3.00	3.05@3.20	2.65@3.00	2.65@3.00	3.35@3.50
Stove.....	2.65@3.00	2.65@3.00	3.05@3.20	2.65@3.00	2.65@3.00	3.35@3.50
Chestnut.....	2.65@3.00	2.65@3.00	3.05@3.20	2.65@3.00	2.65@3.00	3.35@3.50
Pea.....	2.65@3.00	2.65@3.00	3.05@3.20	2.65@3.00	2.65@3.00	.....
Washed egg.....	2.85@3.00	.....	.....	.....	2.85@3.00	3.35@3.50
Washed stove.....	2.85@3.00	.....	.....	.....	2.85@3.00	3.35@3.50
Washed nut.....	2.85@3.00	.....	.....	.....	2.85@3.00	3.35@3.50
Mine-run.....	2.45@2.60	2.45@2.60	2.85@3.00	2.45@2.60	2.45@2.60	3.10@3.25
Screenings, over 1 in....	2.20@2.35	2.20@2.35	2.45@2.60	2.20@2.35	2.20@2.35	2.85@3.00
Washed slack.....	2.15@2.30	2.15@2.30	2.50@2.65	2.50@2.65	2.15@2.30	2.85@3.00

	Clinton and Sullivan	Knox and Greene	Eastern Kentucky
Domestic lump.....	$2.65@2.80	$2.65@2.80	3.10@3.25
Steam lump.....	2.65@2.80	2.65@2.80	3.10@3.25
Egg.....	2.65@2.80	2.65@2.80	3.10@3.25
Small egg or nut.....	2.65@3.80	2.65@2.80	3.10@3.25
Mine-run.....	2.40@2.55	2.40@2.55	2.85@3.00
Screenings.....	2.15@2.30	2.15@2.30	2.60@2.75

ST. LOUIS

An improved situation on everything excepting steam. Car supply short in the Carterville field and transportation poor, with same condition to a lesser extent in other fields. Shortage of men, prevalent everywhere, causes decreased production. Domestic sizes in demand, excepting Standard grade. Light anthracite shipments.

Local conditions continue to show improvement except that the shortage is more acute, with nothing to indicate that there will be any relief. The domestic business continues to come in in greater volume than anticipated, with the exception of Mt. Olive and Standard coal, orders far exceeding the available supply.

Steam coal continues to drag, especially on screenings and the smaller sizes of nut. There is, however, a chance that this condition will get relief on account of the numerous railroad orders for mine-run being placed, which will lessen the production of domestic sizes, and consequently bring about a shortage of screened coal. The situation would be much better if a larger tonnage of the Standard field were mine-run, and this is likely to be the case in the future.

In the Carterville field the tonnage is light on account of labor shortage. Car supply is extremely poor and transportation is far from what it should be. Many of the mines are refusing to accept orders because they are already oversold, and there is no relief in sight for easier conditions here. The same condition is prevalent in the Duquoin field.

Mt. Olive conditions are perhaps the most satisfactory of any. The working time is good, car supply is better than it has been for a long time, and the movement of coal in this field seems to improve. The tonnage just about takes care of the demand.

The Standard field presents an entirely different problem, and the only thing that has prevented a panic here is the fact that the railroads have been buying heavily on mine-run.

Steam sizes in this field are unusually heavy and restrictions on equipment, even under the Government supervision, are unfair and have kept coal out of territories needing it and crowding into territories that cannot use it.

There has been little anthracite coming in, and local conditions are satisfactory, with the exception that there is a demand for Carterville field that is causing anxiety on the part of those who have sold ahead.

The circular here is per net ton f.o.b. mines:

SEATTLE

Washington mines will not be able to meet demands. Greater increase in consumption than production aggravated by withdrawal of fuel oil.

Estimates of the production of coal mined in this state this year as compared with the estimated consumption, together with the prospect of heavy withdrawals of fuel oils, indicate that contrary to expectations Washington mines will not only be unable to ship coal to Montana and Oregon, but will not be able to supply the needs of consumers in this state this fall and winter. Last year this state produced 4,002,749 tons of coal and consumed 4,161,402 tons, of which 356,000 tons were imported from British Columbia and the East. As over 150,000 tons of Washington coal were shipped to Montana, Idaho and Oregon, the mines of the state more than cared for local demand. But such is not the case this year. The estimated production is 4,600,000 tons, an increase of practically 600,000 tons this year, with a consumption of 4,836,800 tons, an increase of 675,000 tons. The state cannot expect very heavy importations from British Columbia, for the Province finds itself facing a similar problem—increased consumption as a result of industrial expansion and the withdrawal of fuel oil.

Recently the tanker "Schofield," with a capacity of 100,000 barrels of oil, was withdrawn from the local field, and advices state that two more tankers will be taken into the Government service before the close of the month. On top of the withdrawal of tank steamers which has been occurring for months past comes a reiteration of the statement from oil authorities in California that the supply in the South will not be large enough to meet demands. Within a year a daily shortage of 50,000 barrels is predicted. Anticipating this the fuel administrator's office here has urged the conversion of oil burners to coal with the result that a greater task has been placed upon Washington mines than they can fulfill. Indications are that Washington will be at least 250,000 tons shy on demand in this state, and how much more rests entirely with the amount of oil that is to be withdrawn. Coal producers, heads of industrial plants and transportation men conservatively estimate that before the winter is done fuel oil to the equivalent of 500,000 tons of coal will have been withdrawn from the local markets.